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JOHN F. KELLY, EDITOR

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A. I. & S. E. E.

THE EVER ACTIVE ENGINEERING AGENCY

For the Steel Industry and the Equipment Manufacturers, the A. I. & S. E. E. is the Ever Active Agency where the engineering executives of the Iron and Steel Industry meet with the design, application and installation engineers of the Equipment Manufacturers. They meet on a common ground to exchange ideas, opinions, experiences in the design, application, selection, installation, operation and maintenance of all steel mill equipment used to process and produce Iron and Steel.

The following tables indicate how closely the A. I.& S. E. E. and the Equipment Builders co-operate in the development of mechanical, lubrication, combustion, electrical and safety equipment for the Iron and Steel Industry.

YEAR 1932

96	Engineering	Executives	working	on	Mechanical Developments
121	"	"	"	"	Electrical Developments
34	"	"	"	"	Combustion Developments
56	"	"	"	"	Lubrication Developments
19	"	"	"	"	Safety Practices
165	"	"	"	"	Design, Application and Installation Practices

CONFERENCES—1932

25	Conferences	Devoted	to	Mechanical Subjects
38	"	"	"	Electrical "
22	"	"	"	Combustion "
19	"	"	"	Lubrication "
12	"	"	"	Safety Engineering Subjects

ANALYSIS OF PAGES OF EDITORIAL MATTER
1932

58	Pages	of	Editorial	Matter	Devoted	to	Mechanical Subjects
188	"	"	"	"	"	"	Electrical "
78½	"	"	"	"	"	"	Combustion "
45	"	"	"	"	"	"	Lubrication "
16	"	"	"	"	"	"	Safety Practices
23	"	"	"	"	"	"	Metallurgical Subjects
70	"	"	"	"	"	"	General Topics

1907—1932

2400	Pages	of	Editorial	Matter	Devoted	to	Mechanical Subjects
2892	"	"	"	"	"	"	Electrical "
1046	"	"	"	"	"	"	Combustion "
1043	"	"	"	"	"	"	Safety Practices
1288	"	"	"	"	"	"	General Topics

1907—1932

149 Pages of Editorial Matter Devoted to Lubrication Subjects

ATTENDANCE—1932

Attendance Committee Meetings, Technical Sessions, Inspection Trips and National Convention 9337

1907—1932

Attendance (approximately) 227,000

1932

Meetings held at Birmingham, Alabama; Cleveland, Ohio; Chicago, Ill.; Philadelphia, Pa.; Pittsburgh, Pa.; Indiana Harbor, Ind. and Youngstown, Ohio.

1907—1932

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ADVERTISING PAGES OMITTED

Rebuilding Mill Costs Reduced By The Use of Arc Welding

By A. F. DAVIS
Vice President, The Lincoln Electric Company,
Cleveland, Ohio.

It has been only a comparatively few years since Welding Departments were established in iron and steel plants. Such departments were organized by progressive executives to salvage apparatus and machinery which formerly were sent to the melting pot to be used as a part of the scrap going to make up the charge for the open hearth. It was soon found that the welding department was cheating the scrap pile, saving thousands of dollars by making repairs to equipment which would otherwise be scrapped. Further savings were made by the lower inventories of spare parts necessary.

Frequently, breakdowns of equipment occurred which were too serious for repair. In order to save time the welding department built new parts or new machines of welded steel. The results were far above expectations and therefore led to the increased use of arc welding for new construction—an experience which paralleled that of other industries. Today the welding departments in most steel plants are busy rehabilitating old equipment and building new. This move has been accentuated by the desire on the part of steel men to use their own product—steel—wherever possible. By using their own steel and the electric arc, they are able to build equipment in their own shops which they would ordinarily have purchased in the open market, possibly from a competing industry, and paid for at a higher price.

FIG. 1—Brackets for supporting the hot runout table are of arc welded construction.

FIG. 2—Fabrication of welded steel brackets for the kickoff shaft and footwalk was accomplished for 50 per cent of the cost of castings.

A remarkable example of how one steel plant cut costs by utilizing arc welding is the rebuilding of a mill at the Canton, Ohio, plant of the Republic Steel Corporation. In the summer of 1932, the company officials decided to rebuild the 12" merchant mill at Canton and convert it into a combination 12" and 16" mill. Engineers were requested to make the necessary changes at the lowest possible cost. In order to do this they decided to substitute welded steel construction wherever possible.

This work was planned and carried out under the direction of C. A. Thayer, Chief Engineer of the Republic Steel Corporation, Leonard Larson, Chief Engineer of the Massillon District, and J. D. Donovan, Electrical and Mechanical Superintendent.

A study of the problem led to the decision to use the shieded arc method of welding exclusively. This process, involving the use of heavily coated electrodes, speeds up the work, provides welds with high ductility and tensile strength of 65,000 to 80,000 pounds per square inch.

Since welding machines and operators were available in the Republic shops, no outside aid was necessary.

Beginning with the hot bed, a great deal of rebuilding was necessary. The supports for the hot runout table were constructed of ½", ⅜", and ¾" steel plate welded as shown in Figure 1 and bolted to heavy I-beams. The bearing supports for the hot bed runout table were welded. Brackets for the kickoff shaft and footwalk were easily built from ⅝" and ¾" plate as shown in Figure 2. All necessary brackets were built at a total cost of one half of that of castings, while the total weight, 6,740 pounds, was more than 2,300 pounds less than the estimated weight.

Probably the most interesting construction at the mill is the various welded parts at the finishing stand. It was decided to build both the sub-bases and shoe plates of steel. For this purpose some 84,000 pounds of hot rolled hot sheared low carbon steel bars were used. Five shoes were necessary; for stands 7 and 10, three shoes 16'6", 7'-7½" and 18'3½" in length and for stands 8 and 9, two shoes each 18'3½" long. One of the longer shoes is shown in Figure 3. It consists of two bottom members 18"x2" x 18'3½", two top members 4½" x 10⅜" x 18'3½", the top and bottom members being joined by a web plate 2" x 11" x 18'3½" welded in place. They are reinforced by three wing plates on the outside and two on the inside. Four cross members join the longitudinal sections as shown in the accompanying photograph. After welding, the shoes were machined, the top being bevelled to a 60° angle, and holes drilled to receive the foundation bolts.

FIG. 3—This mill shoe, 18'3½" long, was one of five built in the Republic shops of steel bars and assembled by arc welding.

There are approximately 1,400 lineal feet of welds most of them 1" fillets, on the five shoes, the total weight being 64,400 pounds. The estimated weight of castings was 77,280 pounds.

The sub-bases for supporting the 12" mill housing and pinions on the above 16" shoes presented a very simple construction job. Five sub-bases, before machining are shown in Figure 4. In constructing the sub-bases, weighing 19,400 pounds, approximately 4,850 pounds were saved and nearly 50 per cent of the cost.

Two bearing pedestals were built quickly and simply with a cutting torch and an arc welder.

Guide trough supports as well as the guide troughs were entirely of welded steel construction. The supports or brackets were fabricated from one inch plate, welded as illustrated in Figure 5. Naturally there was a tremendous savings here over the purchase of castings. The estimate for the cost of castings was $883, whereas the actual cost was only $262.

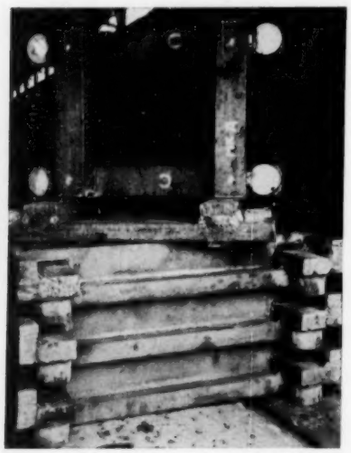

FIG. 4—Five sub-bases for mill shoes before machining.

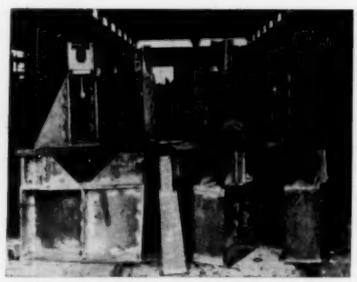

FIG. 5—Brackets for supporting guide boxes at finishing stands were built of 1" plate.

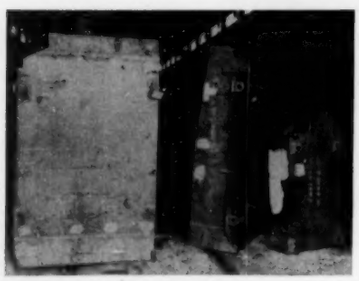

FIG. 6—Three chute boxes; 5"x5" billets were welded to the flanged end opposite the lifting lugs to act as counterweights.

Guide troughs or chute boxes, three of which are shown in Figure 6, were built for a little over 50 per cent of the cost of castings. These were constructed throughout of ½" plate. At the flanged end opposite the lifting lugs, 5" x 5" billets were welded in place to serve as counterweights. Most of the welds on the chute boxes were continuous fillets, but there were a few butt welds.

A new bearing bracket and cap for the edging mill was necessary. This, too, was welded with a consequent weight saving of 420 pounds out of the casting weight of 1,550 pounds.

Some doubt was expressed as to the advisability of welding table rollers. It was decided, however, to weld seven. Four of these shown in Figure 7 were rollers for guide plates. They were built of 10" O. D. pipe, 1" thick, with four braces at each end holding a block 4¾" in diameter and 2¾" long, in place. After welding, this block was drilled and machined to receive the shaft and bearings.

Three rollers for the finishing train were constructed in a slightly different plan. These are 6⅝"

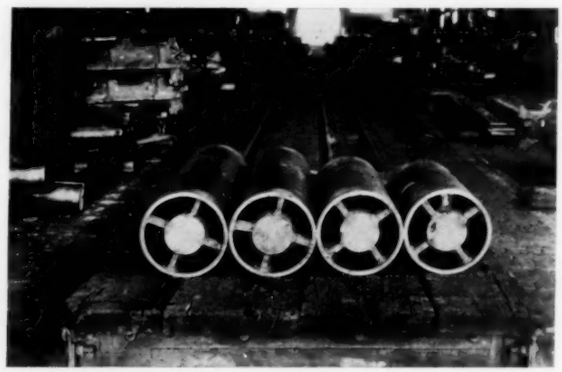

FIG. 7—These 10" welded steel rollers are light in weight, economical to build, and well balanced.

in diameter with the bearing housing held in place by four ⅞" diameter rods welded as shown in Figure 8.

Welded steel rollers are lighter than cast rollers, are cheaper and much better balanced. With welded construction, it is possible to obtain an even distribution of weight. The total weight of the seven rollers built was 1,226 pounds and that of equivalent castings 1,928. Although this weight savings was remarkable, it is true that with the experience gained on this particular job, weight of welded rollers could be still further reduced without sacrificing strength. It is interesting to note that the cost of these seven rollers was only 38 per cent of the estimated cost of castings.

Many other small parts were welded in rebuilding the 12" mill. They included spindle carriers, frog plates, bearings on kickoff mechanism, thrustor

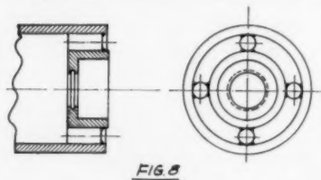

FIG. 8

FIG. 8—Another type of roller construction—used for the finishing train.

base for operating switch plate on runout table, levers, links and bearings for the cooling bed kickoff drive, bore and clamps for Schloemann table rollers, and miscellaneous small parts. Where possible,

scrap was used in the fabrication, thereby further reducing the costs. It is estimated that the average saving on welded construction was 45 per cent.

All welding was done in the Republic shops using one 600 ampere, two 400 ampere and two 300 ampere machines all manufactured by the Company with which the writer is connected. The shielded arc process of welding using heavily coated electrodes was utilized exclusively. The sizes of electrodes used were 3/16", 3/8" and 1/4".

▲

Hot Rolling—Cold Rolling—Single Stand Mills—Continuous Mills

By A. P. STECKEL
President, Cold Metal Process Company, Youngstown, Ohio.

▲

Presented before the Cleveland District Section of the A. I. & S. E. E., December, 1932.

Your large assembly here this evening results, no doubt, from the interest your membership takes in subjects which have to do with the advancement of all forms of engineering to your industry. I intend to discuss the merits of working with single stand mills, as compared with continuous mills, both in the fields of hot rolling and of cold rolling.

Development of four-high roller bearing mills in the past few years and extensive use of them in sizes from the largest to the smallest, clearly indicates, for the immediate future, a very broad general application of the strip process to the production of all flat products, beginning with plates, and ending only with the very thinnest materials. Such new development means, of course, the abandonment of two-high and three-high hot mills in rolling the wide flat products and also, largely, the abandonment of two-high cold mills, not only in the wider sizes but even down to the very narrowest mills. These developments, in fact, mean nothing but a cure for the weaknesses that were always inherent in two-high mills when employed on wide flat products in hot rolling, and the much more pronounced weaknesses of the two-high mill when employed in cold rolling of all widths.

Up to a few years ago practically all rolling of all sorts, whether hot or cold, was done on two-high mills. For this reason we should not speak too confidently of their abandonment without giving convincing proof of their limitations as well as proof that the mills that are to supplant them have surmounted these limitations. The satisfactory ability of two-high mills to roll rounds, squares, rails, structural sections, and relatively narrow widths of hot strip even in long lengths is well proven, and will doubtless stand, but the two-high mill runs into most serious limitations on wide sections, especially if width occurs in connection with thinness of product. That is, of course, because roll pressures increase directly with the width of product rolled, and also with the hardness of the product. The much greater hardness encountered in cold rolling naturally ran the rolling pressures up tremendously and consequently left no practical means for cold rolling hard metals such as steel except recourse to very low speed.

Fifty years or more ago the inherent weakness of two-high mills as to bending of rolls when rolling wide plates was recognized and cured by a Mr. Lauth who stiffened the mill against roll bending by developing the three-high design. The still better four-high design is perhaps as old as the three-high, but we want to emphasize that both of these old developments aimed only at stiffening the mill against roll deflection, which in fact they did accomplish.

However, in neither the old three-high nor old four-high design was there any aim to raise the possible rolling speed of the mills by doing anything to improve the capabilities of the bearings that carried the rolling load. It should be noted here that both the old three-high and old four-high designs did in fact reduce the unit pressures in the neck bearings, and so did raise the possible rolling speeds that might have been attained, but no notable use was made of this fact because there was no reason for raising the rolling speed in dealing with the relatively short pieces (plates and sheets) that were rolled on the early three-high and four-high mills. One exception to this statement should be noted, this being a disclosure by Mr. Tytus in 1925 as to a proposal to utilize three-high mills to raise rolling speeds somewhat in a hot sheet mill, so as to help obviate the necessity for re-heating in a continuous hot sheet process. It should be said here that a three-high or four-high mill which carries the rolling load on brasses can roll short pieces at speeds which cannot be maintained in rolling long pieces, long enough to be classed as strip. This is because lubrication of brasses can be re-established, and heat of bearings dissipated, when the load is off of the mill between pieces, but such lubrication and dissipation of bearing heat cannot be sufficiently effective for the rolling of more than a certain limited length of piece.

Whatever the facts may be as to the origin of the four-high roller bearing mills, it is agreed that it was the urge of the development of the strip process, and not of the sheet process, that stimulated this recent development.

To focus attention on the one essential of the new strip processes in general, it should be said once for all that the essential feature is the four-high roller bearing mill stand, and that there are two essential features of this essential mechanism. The first feature is the fifty-year old idea of stiffening a mill against distortion by the rolling load. The second

feature is the ability of the mill to perform perfectly at high speed, without any distress from bearing troubles, in rolling the very longest pieces that may be desired.

High speed has, of course, always been an essential in rolling hot strip, so that the four-high mills have not had to raise the speeds employed in hot rolling, but they have vastly increased the possible widths of strip that could be rolled. In the field of cold rolling, the four-high roller bearing mills have not only vastly increased the possible rolling speeds, but have at the same time also greatly increased the possible widths of any given gauge over former practice. Wide thin cold strip could have been produced by four-high mills employing brasses to carry the rolling load, but only by resorting to very low speed. Very little was in fact done on this possible stage of progress before the roller bearing mill, with its higher possible speed, came in to occupy that whole field.

The one physical fact on which these notable advances rest is the ability of a roller bearing, if sufficiently large, to carry very heavy loads at high speeds without troublesome heating or serious wear and upkeep. These bearings themselves could not be applied in heavily loaded two-high mills on account of inherent space limitations. Two-high mills which are not heavily loaded, such as bar mills and hot strip mills rolling the narrowest products, can be fitted with roller bearings with beneficial, though not revolutionary, results. Such mills carry light loads on the neck bearings relative to the loads carried in strip mills, which, by definition and practice, mean mills capable of rolling flat material of a width approximating the available space between housings. The space limitations which precluded using roller bearings on two-high strip mills did not apply to properly proportioned four-high mills, and, as soon as this fact was recognized and applied in practice, there was naturally a revolutionary advance in the whole related art.

It is apparent at a glance in comparing the four-high roller bearing stand with the equivalent two-high stand, that the former is very much more expensive. In spite of this fact, and other things being equal, it is still not seriously argued that the four-high stand is not well worth the difference in cost where its use is justified. However, there still remains a wide-spread misconception unfavorable to the four-high mills on the ground of high first cost. This idea dates back to the first wide-spread use of these mills in which they appeared in continuous trains.

It seems well right here to criticize two features unfavorable to continuous mills in general, both these features assuming greater importance as the mills are widened out.

The first feature has to do with the inherent inability of the mill stands to yield a service commensurate with their cost on account of the relatively low speed imposed upon them. This is true in greater or less degree of every stand except the last or delivery stand, which runs at the highest speed. The criticism applies most sharply, of course, to the first stand, which is moving at a very small fraction of the speed of which it would be capable if operated independently of the following stands. It results then, especially in the case of wide continuous hot mills, in multiplying by four, five, six or more the first cost that is necessary to obtain the benefits of four-high operation. This consideration of the inactivity of expensive four-high stands in a continuous mill led me some years ago to contrive to use one single four-high reversing stand to do the entire work of the continuous mill; this seeming to be a reasonable undertaking from the fact that the continuous stands were really duplicates of each other, differing only in that the screwdowns of the successive stands were farther advanced with the progress of the piece. The success of such a development would naturally mean a tremendous saving in first cost, and the full speed activity of the one single stand would seem to promise to yield in output a very fair fraction of the capacity of the continuous mill. After experimental development, which took about two years, such a mill was developed to a successful issue somewhat over a year ago. For lack of time, it is not intended to dwell too long this evening on detail discussion of this single stand hot mill, but it seems proper to say that the capacity of such a mill can be stated from experimental data as in excess of ten tons per hour per foot of width. This figure applies to steel rolled to 12 gauge from an initial slab thickness of four to five inches. The weight of single piece practical to roll in this type of mill is easily as great as one ton per foot of width, which is in excess of the weight possible to produce in the existing continuous hot mills.

The ability of a hot mill to produce strip in extraordinarily long lengths has been made important principally by a special requirement of the single stand reversing cold mill. This requirement will be explained later in discussing the cold mill.

The ability of the hot mill to roll pieces of extraordinary length is due to provision for maintaining any desired rolling temperature by keeping the hot strip on coilers in hot chambers close up to the mill on either side. Maintaining in this way any desired temperature throughout the rolling operation not only facilitates the rolling itself, but takes care of special metallurgical requirements of a number of metals such as high silicon steel, monel metal, high carbon steel, brass and extremely low carbon metals of the character of Armco iron.

In addition to holding desired rolling temperatures in the strip, a fortunate result of storage in the hot chambers during the rolling is a pronounced tendency to keep the edges of the material notably hotter than the interior, this being exactly the opposite of the condition in all other hot rolling practice, where radiation is taking place, which naturally results in leaving the edges colder than the interior. It has been found that the maintenance of a high temperature on the edges of the strip in this new type of mill contributes very favorably to preventing the wear of the rolls at the point where the rolls ordinarily cut out first, that is to say, at the part of the rolls that is rolling the edges of the material.

Criticism of this single stand mill has centered principally on the fear that work rolls that are performing the whole rolling operation from slab to finished product would wear out so fast as to make the whole mill impractical. In answer to this criticism it can be said that sufficient work has already

been done on this type of mill to enable us to say that on low carbon steel a pair of rolls will produce a material of good finish after producing sixty (60) tons per foot of width of product of 12 gauge. This would mean in the worst case changing rolls once every six hours when working at normal capacity. This is a conservative statement as to rolls of indifferent quality that have so far been used, and improvement in this respect can be looked for whenever better rolls become available.

It is admitted that rolls must be changed in this mill at shorter intervals than is necessary in a continuous mill. Over against this disadvantage, however, it can be said that when attention is once focused on providing a roll-changing rig capable of changing rolls in a few minutes, which is clearly in sight as a possibility, this objection to the mill on the ground of rapid roll wear very largely fades out. When wide widths of product are to be considered, the only alternative to this mill and a good roll-changing rig is the initial expenditure of extra millions of dollars for a wide continuous mill. The argument then seems to stand in favor of the single stand mill by a very wide margin.

There has been much criticism of this hot mill from some fancied inability to get rid of scale. This criticism can be based upon nothing but the fact that the one only existing mill of this type happens to have none of the ordinary provisions for taking care of initial furnace scale. However, there is no reason for not installing any of the well-known scale devices in connection with these mills, just as they are installed in connection with continuous mills. In fact the advantage seems to lie rather in favor of the single stand mill from the fact that it provides for sharp bending of the material at each pass throughout the coiling operation, thus loosening and throwing off the secondary scale continuously, this feature not appearing at all in continuous mills.

There is no known limitation on this mill, in comparison with continuous mills either as to width or as to the finest gauges possible to roll, the advantage, if any, seeming to be in favor of the single stand mill on account of easy maintenance of desired rolling temperature.

Much of the foregoing criticism of continuous mills applies as well to continuous cold mills, and this consideration had much to do with my preference as early as ten years ago, for developing the four-high cold stand for single reversing operation, aiming at getting high capacity by extraordinarily high speed and correspondingly high power in one stand, rather than to encounter the first cost and prospective operating difficulties of continuous cold stands.

The second general criticism of continuous mills has to do with a consideration just now mentioned, which is the operating difficulty of continuous mills when they attempt to roll difficult sections, by which is meant sections that are wide relative to their thickness. It has long been known that such sections require close following up by adjustment of screwdown, etc. even when rolling in single stands. It was the prospective difficulty of making and maintaining proper simultaneous adjustments in continuous stands that led me to avoid an attempt to employ them on difficult thin sections. From experience of all parties up to date, it seems about time to agree that even outside of the relatively high cost of continuous cold mills, they should be regarded as suitable only for rolling products that are relatively crude and easy to roll. Conversely the single stand cold mill, just as in old two-high practice, should by this time be regarded as able to roll successfully the thin, wide sections much better than the continuous mill.

Since the first mention of general criticisms of the continuous mill, I have been stating general reasons for confining my own developments, both in cold and hot rolling, to the operation of single stands, rather than continuous stands. From here on I will discuss only the single stand cold mill, to which perhaps I have been expected to confine my talk entirely.

The aim in the single stand cold mill development was to realize in the very highest degree the full capabilities of the four-high cold mill by exaggerating all of its inherent merits. The practical aim was to produce tin plate by cold rolling by a cold strip process, cheaper and better than by hot pack rolling, and without arduous labor.

First, to take care of the rolling pressure without distress in bearings at high speed, use was made of very small work rolls to give very small working pressure. With this small work roll diameter was combined an exaggerated backing roll diameter, which should give both unlimited stiffness to the mill and accommodation for roller bearings so large as to run a lifetime at high speed without deterioration. By high speed is meant rolling speeds ranging from a figure above the speeds formerly employed up to speeds of the order of 1500′ per minute or more. It was apparent that a limitation on smallness of work roll was imposed by inability of a roll of less than a certain diameter to transmit the necessary driving torque. Since, however, more or less delivery tension is always necessary in cold rolling to yield straight unwrinkled product, a happy solution of the small roll difficulty appeared in letting the delivery tension furnish all the motive power, thus relieving the work roll of torque transmission entirely. This solution of the torque difficulty has enabled us to use work rolls as small as 2″ diameter 7″ long, 3″ diameter 20″ long, 5″ diameter 38″ long; the length mentioned being the length of body between neck bearings. The 2″ and 3″ diameter rolls are small enough to obviate intermediate annealing in rolling the hardest metals, practically from any gauge down to any other desired gauge, without an intermediate anneal. This cannot be said of the 5″ diameter rolls, which, however, enable the rolling of low carbon steel to any desired degree of reduction as in tin plate production, without intermediate annealing.

By way of illustration of the capabilities of these cold mills resulting from the smallness of the rolls they are able to use, it can be said that the very tough stainless alloy, 18% chromium, 8% nickel, has been rolled between 3″ rolls from an initial thickness of ¼″ and width of 18″ down to .018 thick without an intermediate anneal. With the 5″ diameter rolls we have rolled low carbon steel 36″ wide from an initial thickness of .080 down to final thickness of .003 without an intermediate anneal. In cold rolling tin plate an initial thickness greater than .080 is not at all objectionable, in fact an initial thick-

ness as great as .125 maximum may, in certain cases, be advantageous.

These performances as to avoiding intermediate anneal, when taken in connection with the widths that have been mentioned, make out a very strong case for the use of small diameter work rolls. When the great length of these rolls relative to their diameter is considered, it will be seen to have been demonstrated that work rolls of these extreme lengths are stiff enough of themselves to obviate the necessity for lateral support such as is provided by so called "cluster" mills. The controlling reason advanced for the cluster design is that it provides a needed lateral support for relatively small work rolls. In answer to this fancied advantage of cluster mills, it should be said here that the four-high design carried to the extremes that have been indicated above, proves of itself that there never is any real occasion to support work rolls in the cluster manner. By this is meant that for any assumed diameter of work roll, and any desired corresponding width of mill, there is always a stiffer mill available of the four-high design than is possible in the cluster design. Stiffness as mentioned above means stiffness in the vertical direction.

As to stiffness in the horizontal direction, and any fancied need for such stiffness, it can be said that no existing four-high mill has ever suffered for lack of horizontal stiffness, even when employing the extreme proportioning of work roll dimensions that we have just been mentioning. We are, in fact, prepared to go much farther in increasing the ratio of mill width to work roll diameter by abandoning, in extreme cases, the neck bearings on work rolls and substituting a babbitted bearing which engages the whole work roll body. Experiments have clearly indicated that this is feasible. When this is done, work rolls small enough to roll the hardest materials without intermediate anneal can be employed on mills of practically unlimited width.

Somehow there seems to be an impression to the effect that this type of cold mill is inherently unable to take heavy drafts, also an impression that the high speed at which it is operated is a controlling factor in rendering it unable to take heavy drafts. This erroneous impression is readily traced back to the fact that some of the earliest mills of this design happened to be used entirely on special materials of extremely light gauges of only a few thousandths of an inch. When, however, the mills were put to work on much heavier products, such as tin plate, motors and gearing were provided for standard reductions of 15% on every pass, and it is an everyday practice on some of these mills to take reductions as high as 30%, aiming always as far as possible to use up the full overload capacity of the motors, in the form of torque or in the form of speed, or of both combined. In answer to all doubts as to limited capacity for drafts, it should be said that these mills are now being put out equipped to employ more horsepower per inch of width of mill than any other cold mills in existence.

We are hearing nowadays of some startling performances of cold mills in taking reductions of 50% per pass and the like, but reports of these spectacular performances are not accompanied by equally glowing accounts of the accuracy and uniformity of the gauges of the product so produced, nor of the flatness and generally workmanlike appearance of the product. Viewed historically, it should be remembered that in the old days of necessarily slow speed cold rolling, the only way to increase production was by taking heavier and heavier drafts, up to the point of failure of the mill to make the reduction. However, now since unlimited speed is available, it is no longer to be regarded as a valuable achievement to make spectacular drafts, if in making such drafts any one single adverse effect results, such as failure in accuracy or uniformity of gauge, buckled or wrinkled product, and the like. While on the subject of accuracy of gauge, it should be said first that a mill employing very small rolls and excessively stiff backing rolls is inherently a mill for producing very uniformly gauged material.

Conversely, the worst form of mill to yield uniformly gauged product, especially in thin gauged product, is a mill employing large work rolls. It happens that the spectacular performances just referred to of 50% cold reductions per pass have been on mills employing work rolls of over three times the diameter that we find most suitable. In the light of simple calculation born out by experience, we feel justified in considering heavy drafts and large work rolls to be a vicious combination requiring a maximum first cost of apparatus and yielding in return the poorest practical result. In addition to tremendous first cost of mill structure and bearings to carry the rolling load of unnecessarily large work rolls, the load on bearings runs so high, if heavy drafts are taken on thin material, as to insure the rapid deterioration or destruction of these expensive bearings.

The main disturbing factor in obtaining uniform gauge is the inevitable change of temperature in the mill parts. Up to about two years ago this disturbing factor of varying temperature, with resulting contraction and expansion of the mill parts, necessitated frequent stops to apply the micrometer to the material as a guide in making necessary adjustments. If such stops were not sufficiently frequent, mill temperatures often in the meantime would get out of hand to the point of producing serious gauge variation, or even of breaking the material from excessive drafts, this latter trouble being encountered especially when the gauges were relatively light.

We were hence confronted with the problem of devising means for reading accurately the gauge of the rapidly moving strip, and we aimed at readings accurate to .0001". This degree of accuracy is commonly considered unattainable with the ordinary micrometer, even without the difficulties added by measuring an object that is in rapid motion. The devices that failed are not of interest here, but the device that succeeded deserves description fully as much because of its rugged simplicity as because of its successful performance.

The principle employed in this device is the old principle employed in sheet mills, of measuring an initial thickness and length, and thereafter observing only the increasing length to determine the decreasing thickness. To have used the bare principle, as in sheet practice, would have told only the average thickness of a long piece, leaving intolerable errors above and below such average still unknown and uncorrected. To surmount this difficulty we contrived not to compare long lengths but to compare

very short lengths, and to make such comparisons continuously by employing a simple differential device.

This device simply indicates errors in any desired relative velocity of the strip entering and leaving the mill, a geared planetary member moving backward or forward to show any error in the desired length of material on the delivery side of mill. Assume that the desired gauge is .010" and that an error of .0001" is to be observed. This is an error of one per cent and will hence cause an error of .1" in a length of 10 inches or an error of ¼" in 25 inches. This latter length is all that need be rolled to produce one quarter inch of motion of the indicator which the operator is observing, and he immediately makes a slight screwdown adjustment to bring the indicator to rest again. The operator works the screwdown adjustment so as to keep the planetary indicator from moving either forward or backward, thus insuring that there will be as little error in desired length as a fraction of an inch in a mile of product. It will be seen that this negligible error in length applies not only to the total length but to all small component parts of the total length. Hence the overall result is to yield a final product that bears any desired ratio of thickness to the thickness of the original raw material. The only micrometer measurement is measurement of thickness of the raw material. It will be seen that errors in measuring the thickness of the raw material affect the final thickness only fractionally. Thus an error as great as .0004" in measuring raw material .080 thick produces an error of only .00005" in final product .010" thick.

The overall result of the use of this device, as to gauge accuracy of product, is to enable the production of material at the full speed of the mill and without stopping, with such accuracy as to make any seeming inaccuracy in the product cast as much doubt upon the micrometer as upon the gauge of the material. The other equally important benefit from the use of this device is a vast increase in the capacity of the mill, amounting in the case of fine gauge product to an increase of about 40% in all day capacity.

Once having attained full speed operation of the mill without interruption for applying the micrometer, the cost per ton of cold rolling steel strip for tin plate from .080 to .010" has come down to as low a figure as $2.50 per ton, this cost including direct labor, power, entire roll cost as to first cost and all re-grinding, water, oil, maintaining guides, and all repairs. Upkeep of main bearings over several years of such operation, so far experienced, has been zero.

The preferable initial thickness of pickled hot rolled strip entering the mill for tin plate production is about one-tenth inch, and the preferable length of such raw material is in the neighborhood of five to six hundred feet or more.

This mill, from its ability to cold roll readily and cheaply from heavy gauge raw material to fine gauge product, yields two results, both as valuable as they have been unexpected in the cold rolling art. First, the ability to start the cold rolling operation with relatively thick material yields a saving in pickling and hot rolling that is not offset by the trifling extra cost of the first pass or two of the cold rolling operation. Second, the unusual amount of cold reduction that is made economically possible without interposing an anneal, yields a superior metallurgical result after a final heat treatment, this being found to be notably true in the case of full finished sheets, and any other products wanting the best deep drawing properties.

The special requirement of extraordinary lengths of raw material is a peculiarity of this mill, mainly for two reasons: The primary reason is that the high speeds attained on the mill would not be practical, in view of the reversing operation, if high speed were of only momentary or short duration, as is necessary with short pieces. Once having long pieces available, the high speeds can be maintained for long runs between reversals, thus cutting down the idle time of reversals to a tolerable fraction of the total time. Another way to regard the advantage of long pieces is to consider that the operator does precisely as much work on a short piece as on a long piece, his work consisting in slowing down, stopping, screwing down, and starting back again at every reversal. Thus the operator's labor and the lost time are both precisely the same on a small piece as on a larger one, making costs and capacities thus largely dependent on working with sufficiently long pieces.

A secondary reason for preferring long pieces is that the ends of the raw material that are permanently attached to the drums have a certain minimum of waste length which forms an objectionable percentage of the total length when the pieces are short, but a negligible percentage when the raw material is in long pieces such as mentioned above.

While dwelling on this requirement of the cold mill for exceptionally long pieces of raw material, it should be said that this prospective demand for long pieces was one of the reasons for the development of the single stand hot mill, which is inherently able to produce extraordinarily long lengths without difficulty.

The capacity of this cold mill in producing base gauge tin plate strip of .011 is easily one ton per hour per foot of width. Power consumption is about 100 kilowatt hours per ton of such product if the bare, useful mill requirement only is considered, and about 120 kilowatt hours per ton if power consumption of motor generator sets during idle periods and power consumption of all plant auxiliaries of all sorts is included.

Still another erroneous impression concerning this mill should be corrected. This has to do with the mistaken impression that the mill has economic advantage only in rolling relatively very thin products, where avoidance of intermediate anneals is a great factor. It is true that the mill has become best known for its startling economies in the field of light gauge products. However, its capabilities as to high speed, and accuracy and flatness of product give it an economical field in products as heavy as full finished sheets. To realize these advantages on such heavy products it is admitted that very long pieces of raw material are necessary, but it is expected that our novel hot mill shall produce these necessary long lengths.

A closing remark should be made concerning the electric drive that is used on the single stand hot mill and the electric drive that has been found best for the reversing cold mill. In both cases, the Ward-Leonard system for the control of a direct current

motor has outstanding advantage over all alternatives. Mr. Mohler, who will follow me, happens to have had intimate personal experience in both these classes of drive, and I am very glad to have him present to discuss these matters in the light of his experience.

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Electrical Equipment for Steckel Mills

By F. MOHLER
Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

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Presented before Cleveland District Section of the A. I. & S. E. E., December, 1932.

After listening to such an able and interesting presentation of this rolling process, by Mr. Steckel, and his description of the precision mills which have made this process possible, I present the following discussion of the electrical equipment with somewhat of a feeling of humility. However, it is indeed a rare privilege to be given the opportunity of discussing the electrical details on the same program in which the mechanical details are presented by the mill builder himself.

The primary object of any rolling mill is to produce steel, but steel for a definite purpose, having definite physical properties. The machine must not only produce the desired product, but must have an output which (even under the present state of competition) will pay a reasonable return on the capital invested. Although these are questions primarily of mill design, the electrical equipment must be fashioned with them in mind.

We have here a mill for producing exceedingly thin strip of very high quality, gauge accuracy, and finish. As Mr. Steckel has explained to you, one of the fundamentals is that of pulling the strip through the rolls. The working rolls are not driven—all power for rolling is applied through the strip itself. Bearing in mind the product, it is obvious that torque must be applied very gradually to the motor which drives the reel during starting and accelerating—otherwise, the strip may be stretched unduly, or even broken, with resultant variations in gauge and possible damage to the rolls.

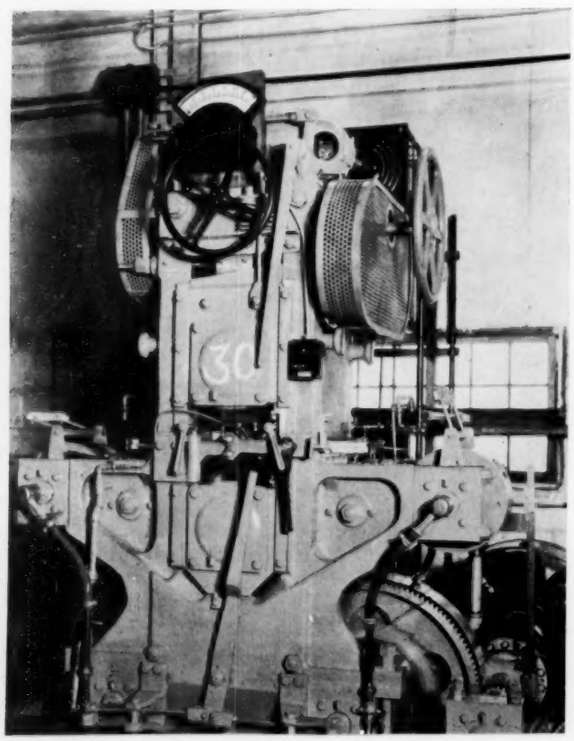


FIG. 1.

This fact gives us a clue to the answer of one of the questions in our minds which occurs most frequently. Is a separate generator necessary?

It is commonly granted that the adjustable potential system of motor control, wherein the motor is connected to a separate generator and accelerated

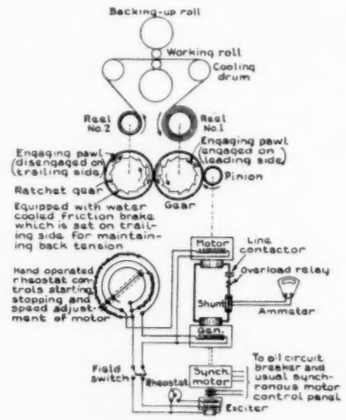


FIG. 2.

by gradually increasing the applied voltage through control of the generator field is the smoothest known method of accelerating. It would require a great number of accelerating points to obtain comparable acceleration with rheostatic starting, whereby the motor is connected to a constant potential source of power through a resistor which is then short circuited in definite steps. Furthermore, because of the length of time required for satisfactory acceleration and the number of reversals necessary, the resistor losses would become quite appreciable.

Other important factors are those of flexibility of control and ease of manipulation. These two factors are conducive to high and economical production. For instance, it is desirable to arrange the equipment so that acceleration may be stopped at any speed for gauging or inspection. Furthermore, if a flaw appears in the strip, the equipment must be stopped very quickly to prevent possible damage to the rolls. In addition, a good operator can tell a great deal about the strip he is rolling by its appear-

ance, vibration, etc. From this he determines the rate of acceleration and maximum speed at which he can roll. He learns "the feel" in some mysterious manner and rolls accordingly. In order that he may give his undivided attention to the strip, the operation has been simplified and, as you shall see later on, all control is centered in a single handwheel.

The adjustable-potential system of control lends itself so readily to the foregoing requirements that the additional expense of the separate motor-generator set is considered warranted.

With this as a background, let us consider the actual equipment that is being used for these mills at the present time.

Fig. 1: Here is a small mill driven by a 100 H.P. motor.

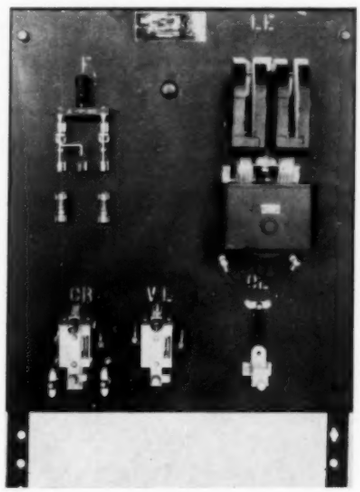


FIG. 3.

The electrical equipment consist of: an adjustable speed d-c. motor; a motor-generator set—with direct connected exciter—for supplying d-c. power; a control panel; a hand operated combination rheostat for the control of starting, stopping, and speed adjustment of the drive; an ammeter; an exciter field rheostat; and starting equipment for the synchronous motor driving the motor-generator set.

Fig. 2: Before going into the details of the control let us review briefly the gearing and method of driving. It will be noted that the main gears rotate in opposite directions. Therefore, it is not necessary to reverse the direction of rotation of the driving motor, but merely to engage one pawl or the other. This is done by a lever which is near the center of the mill.

From the simplified diagram it can be seen that the control of motor speed is obtained through the manipulation of the hand operated rheostat. When it is moved from the "off" position, the line contactor closes, connecting the motor to the generator. Continued turning of the handwheel first strengthens the field of the generator until full voltage is obtained, and then weakens the field of the motor until the desired rolling speed is reached. If the handwheel is turned in the other direction, the motor field is gradually strengthened, then the generator field is weakened, and finally the line contactor is opened. A severe overload will cause the line contactor to open. However, the control is so arranged that the rheostat must be returned to the "off" position before it can be closed again. Furthermore a cemf relay prevents reclosing if there is appreciable voltage across either motor or generator.

The control for the synchronous motor has been omitted because any recognized type of control is satisfactory.

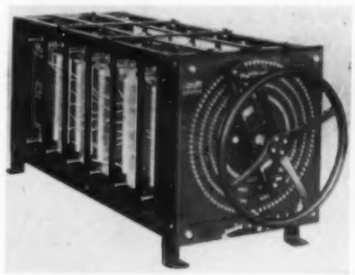


FIG. 4.

Fig. 3: The control devices which you have just noted from the diagram are mounted on a very compact panel. Here is the line contactor, the overload relay, the control relay, the cemf relay and the field and control switch.

Fig. 4: Particular attention has been given to the design of the combination rheostat. The construction is very rugged so as to withstand the severe mechanical and electrical wear imposed by practically continuous operation. Ball bearings and means for lubrication are provided and are arranged in such a manner that the rheostat operates very easily. A large number of points are used in both the generator and motor field sections in order to give small increment changes in speed.

Fig. 5: The rheostat as well as the control panel is placed back of the mill on a common steel structure. The rheostat is connected to the handwheel by a shaft extension. The handwheel is located so the operator can reach it with either hand while observing the strip on either side of the working rolls. On the larger mills where the housing is very wide a handwheel may be placed at either side.

A large ammeter with illuminated dial is placed

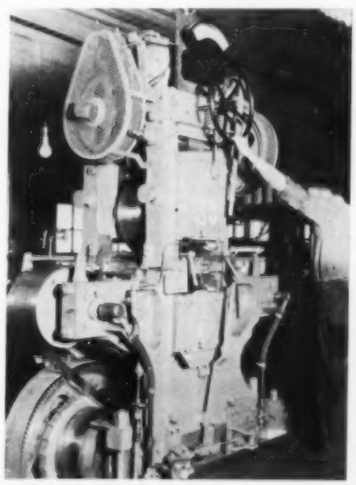


FIG. 5.

on the mill housing for the convenience of the operator in determining the load on the motor, and thereby the approximate tension in the strip.

As the mills increase in size, it becomes necessary to place the driving pinion between the gears

connected to the reels. It follows that the reel gears will operate in the same direction, and it becomes necessary to reverse the direction of motor rotation in order to reverse the direction of rolling. This is accomplished by using reversing contactors for the generator field. These contactors are controlled by a track type limit switch which is operated from the lever which controls the engaging pawls.

Another feature which is desirable on the larger mills, because of the greater stored energy in the drives, is that of dynamic braking. Under any emergency condition, such as a severe overload, which causes the line contactor to open, dynamic braking is applied so that the mill will stop quickly.

Fig. 6: Here is a panel mounting the control devices for these larger reversing mills. You will note that it is practically the same as that for the small mills except for the addition of the reversing contactors and the dynamic braking contactor.

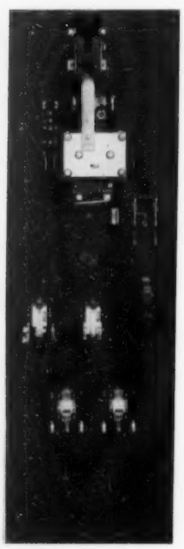


FIG. 6.

One requirement of this mill, as pointed out by Mr. Steckel, is the use of back tension on the strip.

In general, the power required for hold-back tension is approximately 10% of that required for rolling.

There are two methods of obtaining this hold-back tension—by using friction brakes and by using electric regenerative braking.

The choice, of course, is a question of economy. On the smaller drives the initial cost of the necessary electrical equipment, mechanical arrangement, gearing, etc., greatly outweighs the saving in power obtained. On very large drives, however, the use of regenerative braking may cause an appreciable saving.

In case regenerative braking may prove economical, the following scheme has been proposed. A small drag generator of just sufficient capacity to maintain the desired back tension will be geared to each of the reels. These will be alternately (depending upon the direction of rolling) connected to a booster motor forming a part of the main M-G. set. The output of each generator will be controlled by a constant current regulator so that constant tension is maintained.

After all is said and done, however, simplicity is the watchword for these drives, and it is reasonable to assume, therefore, that the very excellent friction brakes, which the Cold Metal Process Company has developed for the purpose of maintaining back tension, will be used on most of the future drives.

And now a word about the motor—its rating, features, etc.:

I might say at the outset that Mr. Steckel and others of his organization have done considerable in determining from actual tests, the strip pull required for various drafts on the materials rolled in his mills.

Allowable strip pulls, strip speeds, draft and the tonnage to be obtained are so closely related to the mill design that it is quite necessary for the mill builder to either calculate the actual motor required or designate the schedule and strip pulls so that the electrical manufacturer can calculate the root-mean-square values.

As a matter of fact tentative motor sizes varying from 50 H.P. to 1750 H.P. have already been selected for the various mills and tonnages, but subject to change depending upon the various combinations of the above factors which may be encountered on a particular application.

It has been found that for various schedules the most economical motor which can be used should be capable of taking 150% load during the early passes. Since the early passes are usually taken at full field speed and since these passes are of rather short duration, a mill motor which will meet the NEMA standards is usually satisfactory.

The motors are shunt wound—first, because there is no particular merit in building them compound wound, and second because the necessity of reversing the compound field is somewhat of a nuisance.

So far, there has been no need of forced ventilation, but in view of possible conditions which may arise in connection with oil or acid fumes and the like, it is recommended that the motors be built so that enclosing covers may be added if necessary.

Frequently the question is raised as to WR^2. I should like to remind you, however, that this is not a fast reversing mill. In contrast, acceleration and deceleration are quite slow as compared to a blooming or a slabbing mill. Furthermore, the passes are quite long. It is believed, therefore, that the slight gain which might be made by using a special motor of low WR^2 is negligible, and unwarranted from a first cost standpoint.

So much for the motor itself.

I should like to mention briefly one point which may have already raised a question in your minds. Since the motor pulls the strip through the working rolls by winding it up on a reel, it is obvious that the load on the motor will increase in direct proportion to the radius of the coil. When the change in coil diameter is quite appreciable, it may become desirable to use a speed regulator so as to maintain a constant strip speed and thereby a more uniform load on the motor. I have mentioned this point to show that it has been considered, and will be used when deemed necessary.

Before passing on to the reversing hot strip mill, let me leave this thought—the outstanding requirements of the electrical equipment for Steckel Mills are smoothness of operation, ease of manipulation, and simplicity.

The reversing hot strip mill is indeed an inter-

esting subject and one, which if covered thoroughly, would take considerable time. Therefore, I am not going to burden you with the details, but will limit my remarks to a few of the fundamentals.

Mr. Steckel has already described this mill, its purpose, and how a slab is rolled down, as quickly as possible so as to conserve heat, to a thickness suitable for reeling in furnaces located on either side of the working rolls.

So far as the slabbing operation is concerned, it is very comparable to our ordinary slabbing mills. However, there is one important difference. The slab is rather long to begin with and attains considerable length before coiling is started. Thus, the passes last for a reasonably long time, and very little can be gained in the way of reducing peak load demands by using the well-known flywheel motor-generator set and liquid slip regulator, or Illgner system. For this reason, coupled with the saving in first cost, it is recommended that a synchronous motor driven motor-generator set be used for supplying d-c. power for these drives.

There is another point which should be mentioned in connection with the main roll drive. It has been the custom to rate reversing mill drives at 50 deg. C. rise, force ventilated. However, due to the long passes and high sustained peaks, which appear to be in the neighborhood of 200% normal load during the early passes, it is quite desirable to base the drives on a 40 deg. C. rise, force ventilated rating.

Fast reversal of this type mill is not essential and has very little bearing on the production capacity because the time of reversal, acceleration and deceleration is short compared to the time actually consumed in rolling. The omission of the special features usually incorporated for obtaining exceedingly fast reversals reduces first cost and simplifies the control.

On the first reeling pass, it is evident that, even though taken at slow speed, the reel on the leaving side of the mill must be accurately synchronized with the delivery speed of the strip—if it is running too fast the end of the strip may pull out of the blades on the reel or if it is running too slow the strip may cobble between the mill and reel.

It might be mentioned that the pinch rolls are raised on the leaving side because they are only required for entering the piece into the main rolls.

After the reeling operation is started, the mill is accelerated to the maximum allowable speed for that pass. During acceleration the reel must be forced to stay in step with the mill motor. In addition, as the rolling progresses, the diameter of the coil increases and it must be slowed down accordingly. The rate at which the reel motor must slow down depends upon two factors—delivery speed, and the thickness of the strip.

As the end of the piece approaches the mill during the first reeling pass, the mill is decelerated to a slow speed.

The pinch roll on the leaving side is then lowered and it too must be in step with the mill. Just as the end of the piece passes through the mill, but before it passes through the pinch rolls, the mill must be stopped. The mill is then reversed and the pinch roll feeds the strip into the mill. Threading the other reel, etc., is the same process as that just described. In connection with the reel which is now unwinding, it should be noted that its speed must now increase as the coil unwinds. Furthermore, a new problem has entered the picture. The speed of the reel depends on the entering strip speed which no longer corresponds to the mill motor speed, but is slower by an amount equal to the percentage draft.

Complete control of direction of rotation, acceleration, deceleration, and stopping is centered in a hand operated master switch which may be operated from a point in front of either reel, where the operator can see the threading operation of both the mill and the reel, as well as watch the progress of the winding or rewinding operation, as the case may be.

In order to lighten the duties of the operator and save time, it is proposed to use automatic pre-set screwdown control.

However formidable the electrical requirements may seem, it is a matter of fact that we have obtained very satisfactory operation even with rather meagre and developmental equipment on the experimental mill. With the experience gained on this mill we feel confident of the results to be obtained with the proposed schemes of control which will be used on a new drive.

New Year's Statement

By A. W. ROBERTSON
Chairman, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

The contrast between January this year and a year ago is marked. A year ago business was running downhill with the brakes off. Now we are no longer going downhill and in some quarters business has improved substantially, although the general standard of business throughout the country is still very low. The future is uncertain and vague in detail but we can see enough to know that 1933 will be a year of gradually improving business. The most hopeful sign is the improved point of view of industrial leaders. The discouraged have passed out of the picture and men of courage and youth are in command.

Everyone realizes that our economic life would be greatly stimulated by some outstanding discovery which would become tremendously popular, making many new jobs and stimulating business generally. I do not think such development imminent nor do I regard it as essential to recovery. The restoration of our factories, commercial buildings, institutions and homes to anything like first class condition after three years of depletion will in itself provide the stimulus we need. Industrial leaders are beginning to recognize this and are planning programs of rehabilitation and modernization on the basis of insuring future earnings. Storekeepers, landlords and home owners are bound to take part in this move-

ment in their own self-interest and when the snowball gets to rolling it will assume mountainous proportions

The development of the electric power industry has temporarily halted and their budgets do not call for much expansion during 1933. The industry, due to the depression and the mistakes of the boom period, is suffering from attacks made upon it by public officials. It is our opinion that it will take a little time to clear away these clouds. This is another case of the many suffering for the few who are guilty. In a relatively short time the power industry will emerge as one of our greatest industries.

This depression has taught the world that we must stand together or perish and it is marvelous how well we are holding together considering the difficulties we are facing due to the amount of unemployment which still exists. Those who are caught in the economic distress are showing remarkable patience and fortitude. On the other hand those still employed are helping out more and more. As a result we are muddling through with a minimum of grief and suffering.

I expect to see a material improvement in business in the next twelve months. This is based on the assumption that our next President will surround himself with wise counsellors and the matter of international debts and tariffs will be settled with reasonable dispatch and good sense. We have a right to expect these results from our statesmen and business men.

ASSOCIATION NOTES

Coming Meetings and Papers

PHILADELPHIA SECTION
SATURDAY, FEBRUARY 4, 1933

"The Use of General Purpose Alternating Current Motors for Special Applications," A. M. MacCutcheon, Vice President in Charge of Engineering, Reliance Electric & Engineering Company, Cleveland, Ohio.

BIRMINGHAM SECTION
JANUARY 28, 1933

"The Application of Diesel Electric Locomotives in the Steel Industry," A. H. Candee, Section Engineer, Railway Engineering Department, Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa.

CHICAGO SECTION
FEBRUARY 7, 1933
WELDING SYMPOSIUM

Lincoln Electric Company, General Electric Company, Una Welding Company and Westinghouse Electric & Mfg. Company will present papers.

PITTSBURGH SECTION
FEBRUARY, 1933
ANTI-FRICTION BEARING SYMPOSIUM

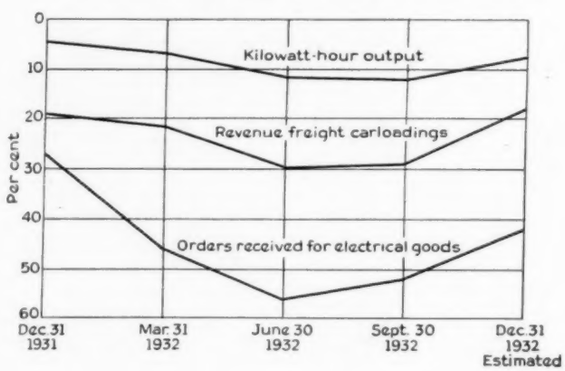
The Outlook For 1933

By GERARD SWOPE
President, General Electric Company,
Schenectady, N. Y.

Possibly the best basis for trying to judge the immediate future is the recent tendencies of the past. For that purpose I know of no better index than the use of electricity throughout the United States. This index is the quickest reflection of business activity because when a manufacturer gets an order he starts a motor to run his machinery and turn out the order, and in the household the increased use of light and appliances may be a reflection of a little more employment or, at all events, better psychology. The accompanying chart shows the percentage relation of each quarter this year with the same quarter of 1931 and indicates there was a decrease in use of electricity in each quarter compared with 1931, but distinct improvement in the last quarter.

Another excellent index of business activities is freight carloadings. When an order is completed and shipped, it is immediately reflected in carloadings. Here the curve is very similar, showing that the low point was reached in the summer of 1932, with a distinctly upward comparative trend for the last quarter.

Per Cent Decrease Each Quarter from Same Quarter Previous Year



Orders received by the electrical manufacturing industry, as reported to the Department of Commerce (with the fourth quarter estimated), show a distinct trend in the same direction. Therefore, we are hopeful that this comparative trend will continue upwards.

1932 And Safety

By JOHN A. OARTEL
Chief of Safety Bureau, Carnegie Steel Company, Pittsburgh, Pa.

Any concern that achieved a fair measure of success during 1932 secured it only through careful planning and hard work or to paraphrase the Bible "Success in 1932 in any line of endeavor came only through fasting and prayer". What was true of business in general was true also of Safety, as there were a number of handicaps to impede its progress. However, Safety not only held its own during the year but also made gains in several important sectors.

JOHN A. OARTEL

The year 1932 saw the rotation of jobs on an unprecedented scale in order to give every employee a share of the work. This meant that men partly or wholly unfamiliar with certain operations were required to perform them. Right here the fundamental training in Safety of both foremen and workmen stood them in good stead and prevented accidents which would otherwise have resulted from the shifting of men from their own familiar jobs to strange and unfamiliar ones. This rotation of work also resulted in foremen having under their supervision men with whom they were unfamiliar and only slightly acquainted. A foreman who had conscientiously trained his men in habits and practices of Safety would often be required to supervise men who had received no direct training from him. In order to keep up the good Safety record of the old "gang" he sometimes had to turn in and do some real Safety work. As the necessity of having to adapt oneself to strange environment and circumstances very often brings out hidden resources of character, so we believe that the foremen and supervisors who successfully met these conditions and held their Safety record intact, were developing themselves for greater responsibilities and opportunities.

We have in mind the case of a foreman in a steel mill, who was a strong advocate for Safety and who was promoted to a department superintendency in another plant of the same company. In the plant to which he was transferred, Safety was in no respect on a par with the plant from which he came. However, instead of accepting conditions as they were and lowering his own Safety standards he immediately asserted himself and Safety conditions began to improve along all lines in that department.

A grave danger that threatened Safety during 1932 was the drastic reduction in inventories in industry, which included not only machinery parts but also safety devices and appliances. The safety director under these conditions needed to exercise great care and wise supervision in order that the proper supplies might be maintained.

A case in point is that of a certain department in a steel mill which needed a new oxygen hose. It was found that there was no supply of the proper hose available and fuel gas hose was substituted. The workman took the hose to the mechanic to be equipped with the proper fittings but the mechanic refused to do the work, as the hose was a different color, the fittings a different size and it was against all Safety rules to substitute fuel gas hose for oxygen hose. The matter was brought to the attention of the safety director, who immediately took steps to maintain an adequate supply of the proper hose at the storeroom.

The part played by the supervisory forces in the prevention of accidents was emphasized during 1932. The president of a large steel corporation has estimated that between eighty and ninety per cent of the accidents that occur in steel mills today are caused by lack of proper supervision. Organization, safeguarding, engineering revision, the use of safety devices and appliances and education in all its phases have all contributed their share to the enviable record in Safety achieved by the American iron and steel industry. It has been demonstrated that the prevention of accidents is a practical business proposition and an economic factor in the operation of industrial plants. This brings the matter of Safety directly to the attention of the plant manager, the department superintendent and the foreman. With the right attitude toward Safety, the supervisory forces would insist that a proper investigation of all accidents be made and the causes ascertained.

The general superintendent of a large steel mill recently decided that his plant was having too many accidents, although the plant was showing a reduction in accidents of twenty per cent over the previous year. He first made a careful analysis of the accident record of the plant by departments, which showed that five departments were having more than their share of accidents, computed on the average number of hours worked per accident for the plant. With this as ammunition, he went right into the departments concerned, shut them down for a half hour and with the aid of a loud speaker talked

"turkey" to the entire force. In this manner he demonstrated his interest in Safety to all the employees, which will undoubtedly result in great good to Safety.

So Safety, like many business concerns, enters the year 1933 standing on more solid ground. During its existence of more than twenty years in steel mills, it has proven its worth. It is standing on a firm foundation because it is constructive and appeals to the finer traits in humanity. It makes for the health, happiness and well-being of every man, woman and child.

Progress—Rolling Mills—Open Hearths—Lubrication

By JOHN F. KELLY
Managing Director, Association of Iron and Steel Electrical Engineers.

ROLLING MILLS

During 1932 no development of major importance has occurred in the heavier type of mills. In the mills for producing the lighter steel products there has been a further development of four-high strip mills so that strip steel up to 72" wide is now produced as hot or cold strip or in sheet lengths.

These wide strip mills, being used largely to produce strip sheets, have intensified the competition between the strip mills and the standard two-high sheet mills. To meet this competition the Sheet Mill is being forced more and more to mechanize by the installation of Continuous Pair and Pack Heating Furnaces with Automatic Mechanical Tables for manipulating the sheets at the Mill in place of hand labor. Installations of this type are now quite common, but these installations are generally confined to the rolling of what is commonly termed "tight iron".

The sheet mills producing full-finished sheets are meeting the wide strip mill competition by the installation of 3-high mills with continuous heating furnaces and tables.

While mechanizing the sheet mills is prolonging their life, they will in the near future be confined to producing the small tonnage orders and the sheet specialties. Where large tonnages are concerned the tendency is to produce hot strip steel in breakdown gauges, cutting the strip in suitable sheet lengths and cold rolling in heavy four-high mills to sheet and tin gauges, thus eliminating all sheet mill heating.

Wide Steckel mills have also been developed and have in recent months attracted considerable attention. Hot strip steel, continuous pickled and coiled, is being rolled to tin gauges to 28" width in this type of mill, and the production of tin plate from hot strip steel, cold rolled to tin gauges, is offering increasing competition to the standard two-high tin mill.

The standard two-high and three-high sheet and tin mill mechanized has the advantage of low installation cost and flexibility. While in these days of small orders and wide range of widths this is of much importance; on tonnage orders they can not compete with the continuous strip mills, and it is only a matter of time when they will be limited to that class of orders which the continuous strip mill does not want.

The Steckel system for producing hot strip steel has been demonstrated during the past year, and while operating men see many difficulties in producing from one set of rolls, that is used for both roughing and finishing, a satisfactory surface, these difficulties will no doubt be overcome.

The tendency during the past year has been for wider and cheaper sheets with no letdown on the rigid sheet specifications.

With the completion of those projects started in 1931 very little new construction was undertaken during the past year; in fact so little new equipment was purchased by the Steel Industry that the machinery suppliers have had one of the leanest years in their history. Normal replacements and renewals have not been made, and it is only a question of a short time when those companies that wish to maintain their efficiency will be forced into the market.

More production and lower conversion costs are continually emphasized today in the Steel Industry as being absolutely necessary to meet the low selling cost of steel products.

Progressive mill management is clamoring for more efficient equipment requiring less man power to operate as the salvation from low prices.

Unfortunate indeed is the position of those Mills whose managements are unwilling or unable to provide modern equipment—their future is uncertain. The coming year should see a very decided movement to modernize many Mills. The leaders in the industry can not afford to idly sit and wait for business to be pushed into their laps. The old soft days of full order books are gone and may not be seen again for many a day.

In both mills and auxiliary equipment anti-friction or roller bearings are being used more and more.

The tendency is to design all mill machinery more rugged and with a greater degree of accuracy. We now talk in thousands, whereas formerly 1/8" was about as close as a millwright could measure. Alloy steels are being used more extensively for those parts which receive excessive wear and abuse.

CRANES

Mill cranes are being built heavier and of more rigid construction and equipped with roller bearings. Steel welded construction for the trolley end carriages and bridge girders is quite common.

Welded steel plate construction is rapidly taking the place of many forms of castings, and as the knowledge of welding increases, whole machines are being built up with welded construction.

OPEN HEARTH FURNACES

No new open hearth furnaces have been built in the past year. On existing furnaces there is an intensive effort being made to cut fuel cost and shorten the time of heats. This has led to several new methods for burning the fuel in the open hearth furnaces. A large eastern company has been trying a top fired furnace and a midwestern concern is advocating firing from the four corners of the furnace. Neither of these methods has been tried on a large modern open hearth furnace. Steady advance has been made in the control of the open hearth furnace. Constant analyses of the exit gases are now possible, and the furnace combustion regulated automatically from these analyses.

Oil as a furnace fuel for open hearth, heating, and annealing furnaces is being used very generally on account of its low cost and a better understanding of how to burn it.

LUBRICATION

The year 1932 has been, no doubt, the low point in the consumption of lubricants as well as in the developments of lubricants and lubricating devices.

This branch of engineering, so far as the Steel Industry is concerned, has, however, made very rapid progress and has assisted the Steel Industry to eliminate many of the troublesome factors that prevailed only a few years ago.

The Lubrication Engineer is today a very prominent factor in Steel Mill Operating Problems. The Steel Companies, who have recognized this new branch of engineering, now realize profits, not enjoyed by those companies who have failed so far to accept the advantages offered by a highly trained lubrication personnel.

When it is taken into consideration that there are over one million lubrication points in the major steel producing plants, any one point, if neglected, ruins a piece of equipment or machinery, thereby causing a loss in production. It, therefore, must be an accepted fact that the Lubrication Engineer has responsibilities equal to any one of the other engineering branches in successfully producing Iron and Steel.

It must also necessarily follow that this broken-down machinery or equipment costs millions of dollars to repair. A great percentage of these expenditures could be saved through the establishment of a Lubrication Engineering Department, the use of proper lubricants and lubricating devices.

Lubrication Engineering Departments are not composed of simply engineers who understand the uses of oils and greases, but of a trained personnel whose experiences cover a thorough knowledge, secured in the field of operation, in connection with the design, installation, operation and maintenance of equipment or apparatus used to process and produce Steel.

Lubrication Engineering Departments in progressive Steel Plants are contributing their share in assisting the Steel Plants to ship steel at less cost per ton than at any time in the history of steel producing.

One progressive plant has been able to cut their babbit costs 60% or from .20 lbs. per ton to .08 lbs. per shipped ton of Steel.

Another progressive steel plant has been able to increase the life of bearings on one of their breakdown mills from 60,000 rolled tons per bearing to 250,000 rolled tons per bearing.

Many steel plants are experimenting with new composition type of bearings with fairly good results. Claims are made by the manufacturers of this class of equipment, that with the use of the composition type of bearings the friction loads are reduced from 20% to 40%. However, it will require a return to normal rolling conditions to prove the fitness and worth of this type of bearing in general rolling mill operations.

Another lubrication problem and experiment that is attracting attention in the Sheet and Tin Mill Departments is a Pressure Greasing System for Hot Roll Necks. This system is in use in approximately seven plants and it is claimed that this system indicates a saving of power, bearing wear and costs. It is claimed for this system also that it eliminates splashing of grease. One of the lubrication problems in connection with hot neck work is to secure a lubricant that will stand up at 450 degree Fahr. and still be soft enough to do the work expected of it.

Lubrication devices for roll necks are slowly being installed and show remarkable savings.

However, the manufacturers of this type of equipment with one or two exceptions are slow to respond with operating information and data concerning the performance of their equipment in use. It would seem that they could profit in organizing within themselves a clearing house or bureau where information and data could be tabulated and later distributed to the users in our field. The Lubrication Engineering Division of the A. I. & S. E. E. is more than willing to co-operate in a movement of this character.

In the field of Gear Lubrication, fluid lubricants seem to have established themselves as capable of carrying fairly extreme loads together with adequate lubrication of the bearings with the same lubricant.

It is claimed the circulating system has proven its worth in eliminating the hard adhesive gear shield that was thought necessary to separate the gear teeth and form a cushion for the shock.

With extreme pressures, the addition of lead oleate or sulphur or both to the gear oils is now being considered as a sane practice where overload conditions exist. The relative worth of one over the other, of the lead oleate or sulphur, seems still a matter of argument. Apparently, both have handled their job satisfactorily.

The Lubrication Engineering Division, under the auspices of the Association of Iron and Steel Electrical Engineers, is printing a number of tables indicating information in connection with the lubrication of roll necks.

This data and information was furnished by the Steel Industry in connection with the paper presented by Mr. W. D. Hodson, at the Lubrication Conference of the A. I. & S. E. E., June 23, 1932.

TYPE OF MILL: MERCHANT

OPERATING DATA
ROLL-NECK-LUBRICATION

KEY TO NAME OF MILL	SIZE OF MILL	TYPE OF BEARING	AVG. BEARING TONNAGE	BEARING COST PER TON	R.P.M. RANGE OF F.P.M.	STOCK ROLLED	AVG. MONTHLY TONNAGE	PRESENT AVG. TONNAGE	% TONNAGE INCREASE	TYPE LUBRICANT USED	METHOD APPLY LUBRICANT	LUB COST PER TON	POWER SAVING	% WATER REDUCED
1 A	14"	Bronze Grids Babbitt Binder	9,000		40-180 RPM 160-790FPM	Billets Bars & Shapes		7000		Solid Tallow-Graphite Grease Suet	Hand Packed			
3 A	18" & 12"	Babbitt												
4 A-1	10"	Steel Box Babbitt & Strips	400	$.00554	435	1½" to 1" Rounds, etc	12,500	Variable		Cold Neck Cup and Tallow	Hand	$.00312		
4 A-2	10"	Lignum-Vitae	3,770	.00372	1135 FPM	1/2" to 1" Rounds, etc	12,700	"		Water	Pipe		No Data	
5 A-1	16"-12"-10"	Babbitt With bronze Wearing Shoe	5,170	1.825¢	18-300 RPM	Basic O.H.Steel	7,750			Suet, Hot Neck Black Oil and gear abials	Packed in necks	.737¢		
5 A-2	16"-12"-10"	Sectional Lignum-Vitae	20,000	.071¢	250-500 RPM	Basic O.H.Steel	7,750			Water				
8 A	10"	Babbitt With Bronze Plates	1,500		400-800	Light sections of Rounds & Shapes	10,500			Tallow Compound	Mech. & Hand	.0150		
9 A	10"	Brass With Babbitt Inserts	4400 GT.	.0306 GT	81-380	1½" Rds.	10,000 GT			#4 Neck Grease	Window Pack	.0148 GT		
13 A	14"	Bronze	2400 Tons	10¢ per Ton	145-190 RPM	Old Rails	5,000	16 tons per hour.		Hot Neck Grease	Hand	6¢		
14 A	9"	Bronze With Babbitt Inserts			700 to 1700 FPM	Merchant Bar, Angles etc.	7,222			Graphited Tallow Compound	Hand Packed	.00583		
16 A	14-9"	Bronze			1000 FPM	skelp up to 6½"wide				Grease	Hand Feed			
19 A	18"	Babbitt Bronze			85-95	Bars, Fla. T. etc.	6,750			#SP 4	Hand	.0138		
20 A	5 stand Int. Mill 16"Roughing	Bronze		19¢		¾" Band to 2 x 4 3/8" to 2" Round	1,800	1,200		Suet	Hand	.026		

FIG. 1.

TYPE OF MILL: CONTINUOUS #1

OPERATING DATA
ROLL-NECK-LUBRICATION

KEY TO NAME OF MILL	SIZE OF MILL	TYPE OF BEARING	AVG. BEARING TONNAGE	BEARING COST PER TON	R.P.M. RANGE OF F.P.M.	STOCK ROLLED	AVG. MONTHLY TONNAGE	PRESENT AVG. TONNAGE	% TONNAGE INCREASE	TYPE LUBRICANT USED	METHOD APPLY LUBRICANT	LUB COST PER TON	POWER SAVING	% WATER REDUCED
1 A-1	10"	Bronze Grids Babbitt Binder	4800		250-500RPM 600-1150 FPM	Bars		2000		Soft, Plastic Roll Neck Grease	Electric Automatic Pressure			
1 A-2	10"	Bronze Grids Babbitt Binder	5700		30-270 RPM 100-820FPM	Bars		2000		Solid Tallow & Graphite	Hand Packed			
1 A-3	18"	Babbitt with Bronze Strips Inserted			16-100 RPM 80-460 FPM	Billets		3000		Solid Tallow & Graphite	Hand Packed			
1 A-4	8"	Bronze Grids Babbitt Binder	2700		30-600 RPM 70-1500FPM	Bars & Shapes		2500		Solid Tallow & Graphite	Hand Packed			
4 A	14"	Steel box Babbitt and strips	500	$.00597	70 RPM	Billets	120,000	Variable		Cold Neck & Bessemer	Hand	$.0047E		
5 A	18" Billet & Sheet Bar	Babbitt with Bronze Wearing Shoe	20,000	.8655	15.8-78.05 RPM	Basic O.H.Steel	30,000			Hot Neck Grease	Packed	.0760		
6 A-1	14" six stand	Babbitt with Bronze Bushings	19,500	.012	17 to 70 Rev.	1¼" to 3" squares, 2" to 11" x 2"to 6" rd	6,500	6,500		Gredag & S	Hand	.0153		
6 A-2	12"-10"-8" stands	Babbitt with Bronze Liner	2,400	.065	30 to 700 Rev.	from ¾"to 1¾" flats, Rds., sqs.	2,500	2,500		#5 Tallow Compound	Hand	.020		
6 A-3	12"-10"-8" stands	Babbitt with Bronze Liner	2,100	.070	60 to 825 Rev.	#5 to 5/8" Rods	2,700			#5 Tallow Compound	Hand	.012		
6 A-4	8"	Bronze Babbitt filled	270 tons	.10	Fin. 700 380-540 Rough.	1/8 to 20 ga. 3/4 to 1¼ wide	1,100			Tallow Compound & suet	Hand	.021		
6 A-5	8"	Bakelite Celoron	11000	.02	Fin. 700 380 to 540 Rough.	1/8 to 20 ga. 3/4 to 1¼ wide	1,500	1,500	36%	Water			36%	None
6-A-6	10"	Bakelite Celoron	5600	.037	Fin. 600. 208 to 320 Rough.	Small flts Loops Angles	860	860	18%	Water			35%	None
6 A-7	12"-10"-8" stands	Lignum-vitae & Celoron	3800	.025	60 to 825 Rev.	#5 to 5/8 Rods	3,500	3,500	29%	Water			32%	None
7 A	18"	Morgan	8500	.007	22 RPM Min 210 RPM Max	Sheet Bars & Billets	30,000	13,351		Tallow Compound	Packed	.027		
8 A	19"	Babbitt with Bronze Plates	14,971	.009	19-121	Billets & Sheet Bar rlates	25,350			#4 Cold Neck Grease	Hand	.0050		
9A-1	10"	Brass with Babbitt Inserts	28,500 GT	.0041 GT.	220-765RPM	1½" rods	8,000GT			#4 Neck Grease	Pressure	.01529 GT		
9 A-2	12"	Lignum-Vitae	31,000 G.T.	.00854 GT	45-610	8" flts Ga	9000 GT			None	None	None		Increase

FIG. 2.

Type Of Mill: CONTINUOUS #2

OPERATING DATA
ROLL-NECK-LUBRICATION

Key To Name Of Mill	Size Of Mill	Type Of Bearing	Avg Bearing Tonnage	Bearing Cost Per Ton	R.P.M. Range Or F.P.M	Stock Rolled	Avg Monthly Tonnage	Present Avg. Tonnage	% Tonnage Increase	Type Lubricant Used	Method Applying Lubricant	Lub Cost Per Ton	Power Saving	% Water Reduced
10 A-1	22" Bar	Babbitt & Bronze	.04¢ per Ton	$.006	440'	1½-12-2-2½ & 3x2 Sq2,4x2	5,000	2,500		Block Grease	Pressure & Block	$.0064		
10 A-2	16" Strip	Babbitt & Bronze	.54¢ per Ton	.09	1000'	4"- 12-5/8 x.040-.500	6,000	2,500		Graphite Grease	Pressure & Block	.022		
10 A-3	12" Strip	Babbitt & Bronze Inserts	.84¢ per ton	.11	1500'	3/4 to 4½ x .035-.500	4,500	2,750		Graphite Grease	Pressure & Pack	.04		
10 A-4	12" & 14" 3 stands	Friction Babs Roll Bushing	.54¢per Ton		1000'	4"- 12-5/8 x.040-.500	6,000	2,500		Graphite Grease	Pressure			
10 A-5	12"	Friction Baby Roll Roller			1500'	¾" - 4½" x.035-.500	4,500	2,750		Graphite Grease	Pressure			
10 A-6	13" 1 stand	Micarta			800'	¾"-4½" x .180-.700	4,500	2,750		Water				
12 A-1	20"	Babbitt With Bronze Inserts			95 Max.	Strip				Grease	Packed			
12 A-2	14"	Babbitt With Bronze Inserts			180 Max.	Strip				Grease	Packed			
12 A-3	12"	Babbitt With Bronze Inserts			116 Max.	Strip				Grease	Packed			
12 A-4	16"	shell			77 @ 375	Strip				Water			30% approximately maximum	None
12 A-5	12"	shell			144 @ 908	Strip				Water			35% approximately Maximum	None
12 A-6	10"	shell			162 @ 804	Strip				Water			40% approximately Maximum	None
14 A	21"	Bronze With Babbitt Inserts			85 to 115 R.P.M.	Billets & Sheet Bar	22,762			Graphited Tallow Compound	Hand Packed	.00673		
16 A	20-18-16"	Bronze			Average 350 F.P.M.	6¾ to 18¾ #skelp				Grease	Hand Feed			
X	10"	Batex	1200		600/800 R.P.M.	Bars & Bands			10 times	Water	Open Flow	None	25%	No Change
17A	18"-21" Bar & Billet	Brass Grid Babbitt	536 tons per brass	.0035		Bars Billets				Chunking Grease	Hand Chunking	.0045		

FIG. 3.

Type Of Mill: STRUCTURAL

OPERATING DATA
ROLL-NECK-LUBRICATION

Key To Name Of Mill	Size Of Mill	Type Of Bearing	Avg Bearing Tonnage	Bearing Cost Per Ton	R.P.M. Range Or F.P.M	Stock Rolled	Avg Monthly Tonnage	Present Avg. Tonnage	% Tonnage Increase	Type Lubricant Used	Method Applying Lubricant	Lub Cost Per Ton	Power Saving	% Water Reduced
8 A	28"	Babbitt Bronze Floats	60,000	$.015	0-120	Structural I-Beams Rails Piling Bars	35,170			Tallow Compound	Hand	$.0120		
19 A	22" 14"	Babbitt Bronze			75	I C Z L etc.	26,000			#SF 4	Hand	.0138		
X	28/32"	Batex				Structural and Piling bars.				water	free flowing			
RAIL										Suet				
3 A	28"	Babbitt												
CROSS-COUNTRY														
4 A	21"	Steel box babbitt and strips	790	$.0092	85	Billets & Sheet Bars.	23,000	Variable		Cold Neck & Bessemer	Hand	.00585		
BAR														
11 A	24"	Babbitt	7,400	.0011	500'	Sheet Bar	17,190			Oredag R3	Hand	.0016		
XX	18"	Textolite	Replacing bearings of average life of 2500 to 5000 tons. At last check Textolite on #6 stand - bottom bearings 40/51000 tons, upper bearings 20/21000 tons. Textolite on #5 Stand Bottom Bearings 53/54000 tons, upper bearings 27/29000 tons.							Water and Block Grease				
STRIP														
X	12"	Batex	2,500		700/900 RPM	Hot Strips			10 times	Water	open flow	none	25/35%	No Change
XX	9¾ x 13"	Textolite	Babbitted bearings lasted two to five weeks. Te tolite bearings after 20 weeks show little wear. Still in operation at end of year.							Water & Roll neck Greases			25%	
8 A	76"	Timken Roller Bearings			108-210	strips.				#1X Heavy Roller Bearing	Mechanical			
17 A	14" Hot Strip	Brass Grid Babbitt	167 tons per Brass			Strip Steel	13,600 net tons			Chunking Grease	Hand Chunking	.05		

FIG. 4.

Type Of Mill

PLATE

OPERATING DATA
ROLL NECK LUBRICATION

Key To Name Of Mill	Size Of Mill	Type Of Bearing	Avg. Bearing Tonnage	Bearing Cost Per Ton	R.P.M. Range Or F.P.M.	Stock Rolled	Avg. Monthly Tonnage	Present Avg. Tonnage	% Tonnage Increase	Type Lubricant Used	Method Apply Lubricant	Lub Cost Per Ton	Power Saving	% Water Reduced
8 A	100"	Bronze	Top 34,000 Bot. 68,000	$.0250	55.7	Plates 3/16"-4"th.	14,000			#7 Keystone	Mechanical	.0080		
14 A	30"	Babbitt	29,304		80 to 135 R.P.M.	Skelp & Plates	14,652			Graphited Tallow Compound	Hand Packed	.0131		
16 A	16"Universal 34" Sheared	Brass Grids			60 to 140 F.P.M.	Plates				Grease	Hand Feed			
17 A-1	112"	Bronze			45 R.F.M.	Steel				Grease	Pressure System			
17 A-2	84"	"			Rough 50 R.F.M. Fin. 80 RPM	Steel				Grease	Hand			
17 A-3	206"	"			75 R.F.M.	Steel				Grease	Pressure System			
17 A-4	Universal	"			72 R.F.M.	"				Grease	Pressure System			
ROD														
5 A-1	Morgan Continuous	Babbitt with Bronze bearing Shoe	6,400	3.66¢	1100 RPM	Basic O.H.Steel	10,000			Suet, Hot Neck Grease	Packed in Necks	.5614¢		
5 A-2	Morgan Continuous	Sectional Lignum-Vitae	25,000	.057¢	1000 RPM	Basic O.H.Steel	10,000			Water				
7 A	10"	Bronze	5,000	.006	20 RPM Min 1300 RPM Max	Wire Mill Rods	12,000	5,477		Tallow Compound	Packed	.042		
14 A	13/32" Round Max.	Bronze with Babbitt Inserts	2,247	.0031	2790 RPM	Wire Rods	7,025			Graphited Tallow Compound	Hand Packed	.00887		
20 A	12" Rolls	SKF Roller				#5 Gauge to 5/8" Rods	1,000	600		Keystone #3C Velox		5¢		
XX-1	10"	Textolite	Bronze ran about seven turns. Textolite after 16 turns showed no appreciable wear			Textolite								
XX-2	10"	Textolite	Bronze stood up maximum of 150 to 300 hours. Textolite on upper rolls after 772 hrs. not worn out. Lower bearing wore 1/8" in 878 hours.							Water and Block Grease				
X	8"	Batex			16/1800 RPM	Rods			8 times	Water	open flow	none	20%	No change
HOT STRIP MILL														
17 A	16"	Brass Grid Babbitt	957 tons per Brass	.03		Strip Steel	21,000			Chunking Grease	Hand Chunking	.03		

FIG. 5.

Industrial Progress

By MARTIN J. CONWAY
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"When industry is stagnant there is every opportunity for active and vigorous minds to discover and advise new methods of production and new methods of organization. It is useless waiting till something turns up. Industrial unrest is fostered, markets are lost, and possible profits are turned into permanent losses." This was the advice given by the late Lord Melchett in his Presidential Address to The Institute of Fuel in 1926.

It is significant that in most industries, the stress of 1932 has not retarded the development of new equipment. If anything conditions have stimulated practical thought. This is particularly true in the automotive industry where the close of the year has shown more progress in design and values than any similar period in the history of the industry.

During times of stress the raw material industries suffer the most. This is particularly true of the coal, iron and steel industries. Our national industrial growth began with coal and is sustained on coal and it is only in recent years that the coal industry itself has ceased to share in the prosperity to which it has contributed. While industrial depression is the main cause of the difficulties of the coal industry, no single cause can be accepted as covering the whole case, and no single cure can be adequately applied.

Modern competitive conditions enforce economies in every section of industrial activity, and in recent years increasing attention has been given by most of the larger users, to fuel economy.

It is much to be regretted that such economies react unfavorably upon the coal industry, but the fact must be recognized that every industry is endeavoring to reduce its fuel consumption and that the result of these efforts decreases the demand for coal in these channels.

MARTIN J. CONWAY

Although these conditions are unfavorable to the coal industry it is desirable that supplies of reason-

ably cheap fuel, which are essential to the heavy industries, should be available.

No one should deny the coal industry existence on a dividend-paying basis, but this existence must be based upon sound technical and commercial progress.

Production of coal is being reorganized on a scientific basis. We must contrive to mine coal more efficiently and to clean it so that the purposes of the user are better solved, and the waste caused by the transportation of dust and dirt reduced. We must also size and grade the coal more accurately for different trade outlets. Drastic changes may have to be carried out in order to make labor saving machinery more efficient and in this direction the services of both the mechanical and electrical engineer will be called into action.

Not until comparatively recently, and only in few instances, little attempt has been made to sell coal as distinct from offering it for sale. It is not sufficient today to expose ourselves to business, we must very definitely go after it. We seldom see the story of coal told, its very real advantages put forward, its best selling points hammered home, as we do the story of other fuels, such as oil, gas and electricity.

In general, coal producers have been backward in the realization that modern trade must be conducted on scientific principles. Coal is our most important source of heat and the whole question of its preparation for the market should be based on this fact. One step is to put into general use a classification of coal, which will place before the consumer a real picture of the goods offered from the standpoint of calorific value, ash content and fusion point, and size.

Most of the large consumers employ engineers to ascertain that they obtain value for their fuel dollars. It should be made possible for the purchaser of even a ton of coal to know, from the classification under which it falls, just what he is buying. Classification once established will automatically direct more attention to the better and more systematic preparation of coal for the market and the elimination of useless material.

From both technical and commercial points of view, this is so clear that it needs no emphasis, and the industry as a unit should take the required action.

A powerful organization could be formed to undertake research and to deal with all matters relating to the preparation and grading of coal for the market, including its known uses and those yet to be discovered. In 1879, the combined production of anthracite and bituminous coal in the United States amounted to 63,000,000 net tons as compared with fifty years later, in the year 1929, of 600,000,000 net tons. As little as one-tenth of a cent per ton mined would provide a fund of $400,000 per year even in these times.

Such an organization would raise the coal industry to the technical and commercial level it deserves.

Diffusion Combustion

By G. R. McDERMOTT
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An outstanding development in the combustion field within the past year has been the commercial application of diffusion combustion to industrial furnaces.

The advantage of heating by luminous flames is universally recognized on account of the great heat radiating power resulting in increased production at lower temperature differentials. The luminosity is due, of course, to the presence of free carbon which not only increases the radiation power of the flame but has a beneficial effect on the surface of the steel being heated. The inherent characteristics of the luminous flame as ordinarily produced are not definitely defined, therefore difficult to control resulting in poor temperature distribution, and occasionally results in high fuel consumption and excessive scaling of the steel being heated.

In order to overcome these disadvantages and at the same time obtain the beneficial results of luminous flames, the diffusion combustion process was developed. In the past year this subject has been given much publicity which, through lack of knowledge of the basic facts and principles of luminous flames and diffusion flames it has resulted in confusion and misapplication.

Luminous flame combustion is not diffusion combustion although in some respects they are similar but in others greatly different. The combustion of gaseous fuel requires a contact of the molecules of gas with molecues of oxygen by mixing the fuel with air. The character of the combustion depends on the method and rate of mixing the two and knowing the combustion characteristic requirement of a

G. R. McDERMOTT

heating operation the correct burner design may be made along definite basic principles. These may be enumerated as follows for efficient clear flame or flameless premix combustion:

1. Correct proportions of gas and air for complete combustion,
2. Intimate mixture of gas and air,
3. Instantaneous combustion,

all of which results in complete combustion at maximum temperature. Any violation of these principles means inefficiency due to excess or deficiency of air in the products of combustion; if the mixture is not intimate, combustion is slow, burning gases mixed with cold inert gases and the combustion is not complete; if not instantaneous or nearly so the result is similar.

The requirements for luminous flame combustion are:

1. Definite flame length,
2. Uniform temperature throughout the length of the flame,
3. Maximum heating power or radiation,
4. No contact of the work with air,
5. Correct proportions of gas and air with complete combustion.

To produce the carbon particles which are heated to incandescence in order to create a luminous flame, it is necessary to dissociate the hydrocarbons in the gas into hydrogen and free carbon, there being no other source of carbon. This is accomplished by progressive combustion of the fuel gas as the gas and air pass through the furnace at the same time burning a portion of the gas to provide the necessary heat required for dissociating the hydrocarbons. To obtain the long luminous flame, the gas and air must mix slowly while passing through the furnace. The flame length then becomes a function of the rate of mixing, thereby establishing the first principle and meeting the requirement of definite flame length.

The second requirement of uniform temperature throughout the flame length will depend upon the rate of mixing of gas and air within the flame—a slow mixing will result in a slow combustion and a relatively cold flame while the reverse will be true. This establishes the second principle in meeting the second requirement.

The maximum heating power or radiation, the third requirement, is a function of the incandescent carbon particles in the flame while its intensity depends on the concentration of such carbon particles. In other words a flame may have sufficient carbon particles to give it luminosity but its radiation power may be relatively low as compared with a black body. Therefore, a luminous flame must contain the maximum number of carbon particles in order to satisfy the third requirement.

Diffusion Combustion process provides for alternate layers of gas and air moving in laminar flow with no turbulent motion. The gas and air are mixed by diffusion, a natural process caused by the constant motion of the gas and air molecules. The diffusion of gases into each other follows natural laws and the rate of mixing by diffusion is definite and may be determined for a given condition. Mixing of the gas and the air by diffusion only proceeds at a definite and uniform rate. This is the basic principle of the process and its characteristics meet the two essential requirements of luminous flames. Under the conditions of gas and air flow required for diffusion combustion it is possible to have a layer of gas on the bottom of the flame which will completely blanket the work and protect it from contact with the oxygen of the air above. With turbulent flow the gas blanket will not be effective as it will mix with the air above and the resulting flame will contact the work indiscriminately. Diffusion flame combustion meets the third and fourth requirements of luminous flame combustion, i. e. maximum heating power due to formation and concentration of carbon in the flame and no contact of the work with the air. The laminar flow and uniform mixing by diffusion, the flame length may be adjusted so that combustion is complete with the correct proportion of gas and air before leaving the furnace. This meets the fifth requirement.

Although both luminous combustion and diffusion flame combustion depend on the progressive mixing and combustion of the gas and air accompanied by luminous flames which may appear to be alike, yet the distinction between the two processes lies in the difference between laminar flow and turbulent flow; in the difference between mixing by diffusion and turbulent mixing and their effect on the character of combustion.

The beneficial effects, which may be expected when diffusion flame combustion characteristics are applied correctly to the industrial furnace heating and melting operation, has already been practically applied and successfully demonstrated in connection with forge and billet reheating furnaces and also glassmelting furnaces.

Developments In Electrical Equipment For Steel Mills

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By H. A. WINNE
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Sheet and Tin Mill Equipment

The sheet and tin section of the industry seems to be going through the throes of a violent awakening, and has shown much activity, evidenced by the installation of automatic furnace and catcher equipments, cold strip mills, Steckel mills, continuous gauging equipment, automatic length measuring apparatus, bright annealing furnaces, and so forth.

A considerable number of automatic catcher equip-

ments for sheet mills have been installed. Due to the extremely rapid operating cycles on these devices, requiring the driving motors to reverse up to a maximum of 40 times per minute, it has been necessary to develop special motors and control equipments. The majority or these equipments have employed fan cooled squirrel cage a-c. motors, but for some types adjustable speed, direct current motors have been used. As evidence of the activity in the catcher field, it is of interest to note that the General Electric Company during the past year has supplied electrical equipment for at least four different makes of catchers.

An important development in this field has been the application of the photoelectric tube as a limit switch to control the automatic operation of the catcher equipment. Equipments of this type are now operating very successfully and possess certain very definite advantages over the mechanically operated switch. The photoelectric tube always gives the operating impulse at the instant that the end of the sheet passes between it and the light source. Where a mechanical switch is used the indication may be given too soon if the end of the sheet happens to be bent upward, as such a bend will permit the operating lever to rise before the actual end of the sheet reaches the desired position. The photoelectric tube also eliminates all of the mechanical linkage, bearings, etc., which are required with the mechanical switch.

For use in connection with automatic catcher equipments a device has been developed and built which permits the roller to get automatically a fairly exact indication of the length of the sheet after each pass. A small Selsyn generator is geared to the mills so that its speed is proportional to the speed of the sheet through the mill. A Selsyn receiver is connected through a small magnetic clutch to a pointer which indicates the length of the pack. The clutch is controlled by the photoelectric cell or the flag switch actuated by the sheet as it comes through the mill. When the front end of the sheet passes the photoelectric tube the clutch is energized, connecting the pointer to the Selsyn receiver, which continuously rotates at a speed corresponding to the sheet speed. Consequently, the pointer begins to rotate and continues until the tail end of the sheet passes through the field of vision of the phototube, which causes the clutch to disconnect the pointer from the receiving Selsyn. Obviously, the position of the pointer at this instant is an indication of the total length of the sheet. The device can be arranged either so that the pointer immediately resets, or it can be held in the final position for a second or two, and then automatically reset. This device saves a considerable amount of the roller's time by eliminating the necessity for actually stopping the sheet and measuring its length. It can readily be applied to any existing catcher equipment.

Photoelectric Tube Radiation Pyrometer

The control of the rolling temperature of steel is becoming an increasingly important problem, especially with alloy steels. Variations of temperature in rolling may cause trouble with the gauge or finish of the material. To measure the temperature of metal passing by on the table, make a record of it on a graphic chart, and perhaps cause several control devices to operate at definite predetermined temperatures, requires a pyrometer with very little inherent time delay. The phototube radiation pyrometer offers a means of meeting this requirement.

The phototube pyrometer utilizes the radiation from the hot metal as an indication of the temperature. This radiation is a very accurate indication since, while the total energy radiated from an incandescent solid varies only as the fourth power of the temperature, the energy radiated within the phototube's "visible" spectrum varies as the eleventh power of the temperature for temperatures in the neighborhood of 2000 deg. F. The photoelectric pyrometer consists of a vacuum type phototube and an amplifying Pliotron tube for changing the microampere output of the phototube into milli-amperes with which either an indicating milli-ammeter calibrated in degrees temperature, or a recording ammeter, may be operated. In addition the control equipment may contain one or more Thyratron relays, from which it is possible to operate control circuits at definite adjustable temperatures. The equipment may be operated on either 60 or 25 cycles, which is converted into d-c. by means of a rectifying tube.

The phototube pyrometer is applicable only to temperatures above 1500 deg. F. It must be so mounted that its field of vision, at the time it is measuring temperature, is always completely covered by an area of the hot metal. As long as this condition is fulfilled a variation in distance between the phototube and the metal does not affect the results.

The speed of response of the phototube, the amplifying Pliotron and the relaying Thyratrons is practically instantaneous. The only time lag in the system is that due to the indicating or recording ammeters which can be made very small.

Torque Amplifying Equipment

A torque amplifying equipment has been developed and installed for remote operation of the hydraulic control valve on a 3000 ton bloom shear. The operator's master switch simply consists of a small casing with a handle connected to the rotor of a Selsyn transmitter. The hydraulic control valve is geared to a 5 hp. d-c. motor which is also geared to a small Selsyn receiver. When the two Selsyns are not in correspondence, Thyratron relays actuate the control panel for the 5 hp. motor, causing it to drive the hydraulic valve to a position such that the two Selsyns are again in correspondence, at which point the position of the control valve will correspond to that of the operator's master switch. In other words, this is a sensitive follow-up system of control which may be applied to any motor whether its capacity be 5 hp. or 5000 hp.

Thyratron Control for Resistance Welders

In line or seam welding with resistance type welders, much better results are obtained if the welding current is periodically interrupted. In the past this has been accomplished by electrically or mechanically operated contactors or breakers in the primary circuit to the welding transformer. Such devices not only require considerable maintenance, but it is difficult or impossible to control accurately

the length of each "on" and "off" period. General Electric has developed a system of control which not only eliminates the necessity for mechanically operated switches or contactors, but also permits of controlling the length of the "on" and "off" periods with extreme accuracy. With this apparatus, instead of opening the circuit through the primary of the welding transformers, a high reactance is inserted which is sufficient to stop the flow of welding current. A series transformer with the primary having a voltage and current rating equivalent to that of the welding transformer is connected in series with the primary of the welding transformer. Across the secondary, or high volage winding, of this transformer, are connected two Thyratron tubes. When the grids of these tubes are excited in the proper phase, the two tubes practically short circuit the secondary of the series transformer for each half cycle, and thereby reduce to almost zero the impedance which the series transformer offers to the welding transformer circuit. When the grids are excited negatively, flow of current through the secondary of the series transformer is interrupted and the full impedance of the primary is thereby inserted in the welding transformer circuit, stopping the flow of welding current.

The Thyratron synchronous timer is a means of automatically changing the excitation in the grid control circuit. In the timer a transformer and two small Thyratron tubes are used in a manner similar to the arrangement described above for the main power circuit. The grids of these two small tubes are controlled by an oscillating voltage produced in a circuit which consists of a group of resistors, capacitors, and reactors. By adjustment of the characteristics of this circuit, by simply turning the handles of a couple of rheostats, the "on" and "off" periods may be controlled.

This equipment may be used either to control line welders in which the on and off cycles is continuously repeated, or spot welders in which the current is turned on for a definite length of time during the making of each spot.

This Thyratron control equipment permits the length of the "on" and "off" periods in half-cycles, to be **exactly** duplicated. Therefore, the welder itself can be adjusted to put the maximum possible amount of power into each "stitch" with the assurance that no stitch will be burned due to overtiming. This feature permits welding at considerably increased speed. The possibility of making the "on" time as short as 1 cycle permits welding of some alloys, such as stainless steels, which could not previously be satisfactorily spot or line welded because of discoloration due to excessive heating.

Progress of Anti-Friction Bearings In The Iron and Steel Industry

By JOHN L. YOUNG
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To have talked of precision in the steel industry only a few years ago, in the terms of precision as we know it today, would have been more or less a joke.

The development of the 4-high mill and precision have gone hand in hand until steel at the present time can be rolled to dimensions of the thinnest paper and the variation in thickness is hardly measureable.

Four-high mills were built before the 20th century but principally for sheets or for narrow strip. Only in the last six years has the 4-high mill come into its own, and we all know the progress it has made both for hot rolling and for cold rolling wide strip in thin gauges.

Roller bearings with their freedom from wear have contributed greatly to the success of the 4-high mill. As the 4-high mill has been developed, so has the heavy duty tapered roller bearing been developed, and with this development the bearings have become larger and better through experience both in application and in manufacture.

It is neither easy nor wise for a manufacturer of production small bearings to suddenly launch into a program of such enormous bearings without making an extensive study of the requirements. It is true that the tapered design has in general not been altered, but the bearings produced today are highly refined compared to the bearings produced for these mills six years ago.

The Timken steel plant was made a preliminary proving ground for these bearings. Here, in the interests of the steel industry at large, some important bearing developments destined to advance steel production and to remarkably reduce production costs took place. Early developments were made which established a firm foundation for continued success in the application of roller bearings, with the result that at present this type of bearing points far towards emancipation from roll neck bearing troubles.

One of the most important items in the development of bearings for rolling mill equipment has been the development of the bearing steel and the heat treatment. After extensive tests both in the laboratory and on roll necks of mills, a special heavy duty roller bearing steel has been developed to stand the terrific strains set up in rolling mill practice.

Close radial clearance in roller bearings increases the load carrying capacity and the ability of the

bearing to take shock loads. As the accuracy and quality of tapered roller bearings have constantly been improved, radial clearance or running clearance in the bearings has been reduced, with a result that the average tapered roller bearing in 4-high hot strip mill back up roll service is now running with about .001" radial clearance which is from 6 to 10% of the minimum clearance possible with other types of roller bearings. On cold mills the radial clearance is usually less than the foregoing figure, and in some cases cold mill bearings are preloaded to take all of the looseness out of the bearings.

The Fraser & Chalmers Engineering Works, Erith, England, recently produced a Timken-equipped Bliss designed cluster mill 4¾" & 9" x 6" with the understanding that the allowable variation in thickness of product would be plus or minus .0001". Actual measurement of the product of this mill since installation in July, 1932 shows a maximum variation in thickness of plus or minus .00007". This, of course, is a comparatively small mill.

Early in 1932 the Sharon Steel Hoop Company replaced six finishing stands of an 11 stand 2-high continuous hot strip mill with four 4-high Timken roller bearing equipped stands 15" & 32" x 24". These four stands were built by the United Engineering & Foundry Company.

It is interesting to note that with the same horsepower required for the original mill rolling a maximum width of 13½" x .125" thick, they have stepped up the width to 20¼" x .062" thick. This, of course, was accomplished through the dual medium of roller bearings and 4-high mills.

The United Engineering & Foundry Co. is now building the largest 4-high cold mill in the world for the American Sheet & Tin Plate Co., Vandergrift Works. The dimensions of this mill are 20½" & 56" x 84". The Timken tapered roller bearings on the back-up rolls are 30" I. D., 51" O. D., and 25½" long, with a rolling capacity at mill speed of 12,000,000 pounds. Each bearing will weigh 3½ tons.

These 51" O. D. bearings, however, are not as large in capacity as the 29½" x 46½" x 29" 4-row bearings furnished the United Engineering & Foundry Co. for a 96" 4-high plate mill at the South Chicago works of the Illinois Steel Company. These 4-row bearings have a rolling capacity at equivalent speed of 14,000,000 pounds.

The ability of The Timken Company to produce heavy duty roll neck bearings of extreme accuracy is evidenced by the fact that material rolled on Timken-equipped mills has never shown periodic gauge variation along the strip which would occur if the bearings were eccentric. If the periodic gauge variation is to be eliminated it is, of course, also necessary to have roll necks and roll barrels concentric.

The design of the tapered bearing lends itself readily to adjustment which in turn allows the proper setting of the bearing for the rolling condition. A bearing of a given size may be used on both hot or cold mills, but for those two conditions must be set with different radial clearances. The fact that tapered bearings are adjustable and can have that adjustment definitely fixed by spacer rings ground to size means that they cannot only be set up with the proper running clearance at the start but can be readjusted at any time wear may occur, whereas other types of anti-friction bearings used on rolling mills must have parts of the bearings replaced to allow the resetting of the bearing clearance.

The fact that the tapered bearing dominates the spindle applications of the machine tool field is good proof of the ability of the Timken Roller Bearing Company to produce precision bearings and of the performance of those bearings in milling machines, lathes, and similar precision equipment.

It seems to be a recognized fact that the tapered bearing is the theoretical and practical solution of roller bearing needs for rolling mills. This is shown by the fact that two other bearing companies who have been building a different type of bearing for this class of work have recently endorsed the principle of tapered roller bearings.

Of particular interest are the many mills completed in 1932 equipped with Timken Roller Bearings. A careful review indicates that 75% of all stands completed in 1932 were so equipped.

TIMKEN-EQUIPPED ROLLING MILLS COMPLETED IN 1932

FERROUS MILLS

Company and Location	No. of Stands	Sizes and Type Mill
Allegheny Steel Co., Brackenridge, Pa.	4	38"—4-High Hot Strip
American Sheet & Tin Plate Co., Gary, Ind.	1	42"—4-High Cold Strip
Babcock & Wilcox Tube Co., Beaver Falls, Pa.	1	Seamless Tube Reeler
	6	" " Equipment
Inland Steel Co., Indiana Harbor, Ind.	10	76"—4-High Hot Strip
	2	48"—2-High Cold Strip
Otis Steel Co., Cleveland, Ohio	5	72"—4-High Hot Strip
	2	72"—4-High Cold Strip
Sharon Steel Hoop Co., Sharon, Pa.	4	24"—4-High Hot Strip
Thomas Steel Co., Warren, Ohio	1	12"—4-High Hot Strip
The Stanley Works, Bridgeport, Conn.	1	14"—3-High Hot Strip
Wallingford Steel Co., Wallingford, Conn.	1	14"—2-High Cold Strip

NON-FERROUS MILLS

E. F. Phillips Electrical Works, Ltd. Brookville, Ont., Canada	11	20" & 14" Hot Copper Rod
Gramaphone Co., Ltd., Hayes, Middlesex, England	1	6" Cluster Cold Strip
TOTAL -	50	

MAIN ROLL DRIVE STATISTICS 1932

H.P.	R.P.M.	Volts	Cycle	Type of Mill	Method of Drive	Date Sold	Name of Plant	Location
400	400-800	230	DC	Cold Roll Mill	Geared	1932	American Sheet & Tin Plate Co.	Vandergrift, Pa.
400	400-800	230	DC	Cold Roll Mill	Geared	1932	American Sheet & Tin Plate Co.	Gary, Ind.
500	240	2200	60	10" Merchant Mill	Direct	1932	Sheffield Steel Co.	Kansas City, Mo.
600	400-800	600	DC	Cold Roll Mill	Geared	1932	Weirton Steel Co.	Weirton, W. Va.
600	300-900	600	DC	Cold Roll Strip Mill	Geared	1932	American Sheet & Tin Plate Co.	Gary, Ind.
1000	400-800	600	DC	Cold Roll Mill	Geared	1932	Follansbee Bros. Co.	Follansbee, W. Va.
1200	500-800	600	DC	Cold Roll Strip Mill	Geared	1932	American Sheet & Tin Plate Co.	Gary, Ind.
3000	450	6600	60	Sheet Bar	Geared	1932	Andrews Steel Co.	Newport, Ky.

Iron and Steel Engineer Index For 1932

The Association of Iron and Steel Electrical Engineers presents to its membership and the Iron and Steel Industry, through its papers and editorial committee, an index of both the subjects and authors of the papers that have been presented before the five different sections, and printed in the Iron and Steel Engineer, for the year 1932. This index, together with the one printed in the January, 1932 issue of the Iron and Steel Engineer, is a complete list of all the authors and papers presented before the Association in the last twenty-six years.

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ITEMS OF INTEREST

PERSONNEL CHANGES

▲

Frank F. Marquard has been appointed general superintendent in charge of operation at the Clairton, Pa., steel works and by-product coke plant of the Carnegie Steel Co., Pittsburgh. He succeeds Henry J. Davis, who retired on January 1, and is in turn succeeded as assistant general superintendent by Robert J. Tully.

▲

The Davis Coal and Coke Company of Baltimore has announced that Carl Stripe will head the engineering activities of the company as assistant to the vice president and will be located at the company's New York office.

Mr. Alan Wood Smith, who has charge of Roll Sales for The Aetna-Standard Engineering Company, has been given complete charge of both sales and manufacture of rolls.

▲

Anticipating an early resumption of activities in its many markets, the Norma-Hoffmann Bearings Corporation, Stamford, Conn., has been making ready with extensive additions to its line of "Precision" ball, roller and thrust bearings. As a step in the preparation for larger production, Mr. John W. MacMorris has been engaged as factory manager, and assumed his new duties on December 15th. He brings to his new position many years of production experience, including 9 years as factory manager for S.K.F Industries, Hartford Plant.

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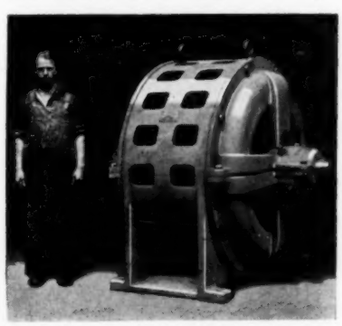

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President DeWitt Page of the New Departure Manufacturing Company with plants at Bristol and Meriden, Conn., has announced the appointment of Frederick G. Hughes as general manager and vice president of the company, effective January 1st.

The other officers of the company were reelected and are: president, DeWitt Page; secretary and general sales manager, Lester G. Sigourney; resident treasurer, Charles S. Joy; resident comptroller, Charles R. Anderson.

FREDERICK G. HUGHES

Previous to coming to the New Departure Company in April, 1911, Mr. Hughes was experimental engineer at the Bethlehem Steel Corporation, Bethlehem, Pa., and chief engineer at the Driggs-Seabury Corporation, Sharon, Pa. Starting as production manager, he has risen rapidly to become chief engineer, assistant general manager and vice president.

Mr. Hughes was graduated from Yale University, class of 1900, and was a member of Sigma Xi. During the war he was advisory engineer to the quartermaster department and a member of the war service committee on hearings.

▲

The turbine sales department of the General Electric Company has been consolidated with the central station department of the company, as a division of that department, it has been announced by Vice President J. G. Barry following the previous announcement of the retirement of Elmer E. Gilbert, manager of the turbine sales department. R. B. Beale, former assistant manager of the turbine sales department, succeeds Mr. Gilbert with the title of manager of the turbine division.

▲

The Trumbull Electric Mfg. Company announces the appointment of Mr. Elmer T. Carlson as Sales Manager of their Panel Board and Switchboard Plant at Ludlow, Kentucky. He assumed duties January 3rd, taking the place of Mr. M. J. Kallaher, who recently resigned. Mr. Carlson formerly was connected with the Boston Office, and has had wide engineering and sales experience.

The Hon. W. R. Hopkins, former City Manager of Cleveland, and at present member of City Council, will address the Cleveland District Section of the A. I & S. E. E. at their regular monthly meeting, Hotel Statler, January 20, and will discuss what he terms "Our Biggest Problem". He will explain that, "For years we have been enlarging the powers of government, adding to the duties of government, increasing our dependence on government, authorizing government to take increasing proportions of our

HON. W. R. HOPKINS

income, and finally trying to create super-government with still greater powers. Meanwhile, we have done nothing to improve either the standards of government or the capacity of those who govern. Our biggest problem is how we can make government equal to the tasks we have imposed upon it".

▲

OBITUARIES

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C. L. Close, who had been head of the Bureau of Safety, Sanitation and Welfare of the United States Steel Corporation since 1911, died on December 26 in Cincinnati. He was 58 years old. Most of his adult life had been spent in corporation welfare work. He had been engaged with such work with the Shelby Tool Co., Shelby, Ohio, and the National Tube Co. in Pittsburgh before his appointment as manager of such activities of the United States Steel Corporation. His home was at Bernardsville, N. J.

Mr. Close was one of the pioneers in the safety movement in industry and throughout his business life was one of the strongest figures in this work. He was one of the organizers of the National Safety Council and at the time of his death was a member of the Executive Committee.

▲

E. M. Herr, vice chairman of the Westinghouse Electric & Mfg. Co., died at his home in New York on December 24 after a long illness. He had been president for 18 years and had given up active direction of the company in June, 1929.